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Who Carries the Short Hauls? 28

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How to make your shots count

A lot of work has been done by a lot of people to increase aircraft stability. And now, from Honeywell, there comes a device that greatly advances the cause of the more stable flying gun platform, so important to accurate rocket and gun firing.

This device is called a Turn Coordinating Yaw Damper. It is now in production and is currently being installed in the AVRO CF-100. That's the all-Canadian fighter, pictured above, guarding the northern approaches to our continent.

The new Turn Coordinating Yaw Damper is a significant advance over earlier Yaw Dampers. With it a pilot can fly with his feet off the rudder pedals. No matter how he moves the stick, the turn—whether transient or steady—will always be coordinated. He is relieved of his concern over yaw, and has more positive assurance that his shots will count.

On the CF-100 the Turn Coordinating Yaw Damper is made to function as the rudder axis for the Honeywell MH-11 Autopilot, with which the CF-100 is also equipped.

The important improvement in performance made possible by the Turn Coordinating Yaw Damper serves to demonstrate how *automatic control* is such an important part of aviation progress. And *automatic control* is Honeywell's business.

MINNEAPOLIS
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Aeronautical Controls

2600 Ridgway Road, Minneapolis 13, Minn.

Aircraft industry, now at peak and due to start downward trend in mid-1954, is showing impressive production figures.

It's building 48 new military planes every working day (about 230 weekly), over half of them jets. Now in production are 23 types of combat jets—15 of them fighters—plus military turpoprop transports and at least one commercial jet prototype.

About 4700 civil planes and utility aircraft will be built this year.

Total monthly production is worth about $900 million—planes, engines and propellers, but not including other components and accessories.

Mid-summer aircraft backlog hit postwar peak of $18.9 billion, engines $5.3 billion, props and other parts $1.2 billion. Sales of planes, engines and parts totaled $4.2 billion in first half of 1953.

Whether percentage of profit to sales will be higher this year is questionable. Last year, 12 largest airframe makers reported 2.2% return on sales—well under 5.4% average of 1,783 other manufacturing concerns.

•

Second major personnel cutback at CAA within six months is expected to break soon. Effects will be felt by all divisions in Washington and the regions. Actual employe layoffs shouldn't be extensive, but many unfilled vacancies are slated for elimination. Other jobs will be dropped through normal attrition.

Coming well in advance of any planned reduction in CAA's fiscal 1955 budget, cutbacks now should avoid another major layoff next June.

•

U. S.-Canadian civil aviation relations are strained.

Canadians have long felt that current bilateral aviation agreement gave them the short end of the deal. Now U. S. has banned Trans-Canada's well publicized Montreal-Mexico City via Tampa service which was to have opened last week (see News at Deadline).

Irked Canadians may now try to place restrictions on U. S. operations into Canada. Mexico incident certainly won't make Canadians more conciliatory at talks they've been seeking on revision of the bilateral.

•

Manufacturers remain wary about accepting claims of business aircraft users regarding size of corporate plane market. Here's what they want before they'll consider starting manufacture of an "ideal" corporate plane:

More valid documentation regarding the specific market that exists.

Unanimity on specifications.

Financial participation—in the form of bond posting or advance payments—in production development of the plane.

•

Often-reported downtrend in private aviation is disputed by Aircraft Owners and Pilots Association—with statistics:

76.3% of its members now own planes against 57% four years ago. Planeowners' average age is 38.1, against 43.8.

16,661 new student pilot licenses have been issued in last six months, plus 5225 private and 2336 commercial. If this issuance rate holds for a year, it will about equal the number of airworthy aircraft in non-air carrier group (51,445).

The Washington View

No Probe Today

There now appears to be little likelihood of any extensive Senate investigations of the aircraft manufacturing industry, much less a look into off-shore buying of military planes.

A majority of the members of the Senate Armed Services Committee have become extremely preoccupied elsewhere. The Republicans, particularly, because of the current fluid political situation, don't want to turn up anything.

The closest the group may come to a probe will probably be centered around the mounting controversy over the C-46 airplane.

Stay-at-Homes

A reduction in official U. S. participation in international meetings, including aviation sessions, which was recommended by the Senate Appropriations Committee, will be put into effect by the State Department.

The Department's action came to light in a letter from Assistant Secretary of State Robert Murphy to member agencies of the Air Coordinating Committee. Murphy advised the agencies that participation in some meetings is being wiped out, while the accustomed size of U. S. delegations to others is being cut back by one third.

First signs of reaction to State's position indicate another bureaucratic tug-of-war has been touched off. The pressures and counter-pressures among the affected agencies are already beginning to show. In one of the early test cases, the Air Force is "insisting" that it be on a delegation, or, if not chosen, that any agreement reached must carry a provision that the Air Force is not bound by its terms.

Distant Measuring

Rep. Carl Hinshaw (R., Cal.), who has long championed a civil-military "common system" of air navigation, is still carefully watching the potentially disruptive dispute over different civil and military systems of distance measuring equipment.

At the first signs of the military's divergence from previously adopted agreements, Hinshaw requested the House Commerce Committee to retain Charles F. Horne, former CAA Administrator and communications expert, as a consultant. Horne's assignment began before he went to Convair as head of that firm's Guided Missile Division and Convair was in full agreement that he continue his work for Hinshaw because of the public service aspect.

The main project Horne has undertaken, although confidential in nature, is to determine what the military classified system means as a duplication of effort.

That Stanford Report

The Air Force may soon have to shake loose its deeply buried Stanford Report if Sen. Russell Long (D., La.) persists in his efforts to compare military versus civilian training costs. The entire report pertains to this matter of Air Force training programs, plus an analysis of comparable civilian services, but it has been kept under wraps since its completion five years ago.

Senator Long has requested a Senate Appropriations Committee staff study on comparative costs of Air Force pilot training as against a civilian training program. A report on the Senate study is nearing completion. The Senator feels that the Air Force could effect a further reduction in the number of uniformed personnel by a greater use of civil contractors, both in pilot and mechanic training.

The civil aviation training industry, which, however, has been getting a better deal from the Air Force in the past 18 months, would stand to benefit more from a comparable study of the Navy's training program.

The Balchen Mystery

Although there has been a great deal of consternation over Col. Bernt Balchen's present status with the Air Force, there is one thing for sure—he has not retired as erroneously reported here last issue. Neither has he requested resignation. At present he is on an emergency leave in Norway.

There is still considerable uncertainty, however, as to just when the Air Force's leading arctic expert becomes *eligible* for mandatory retirement. Balchen is definitely under the impression that he will be forced out of the service in October, 1954. The Air Force, on the other hand insists that he does not face mandatory retirement until October, 1956, when he will have five years in permanent grade of colonel.

The Air Force reads it this way: "The law requires 30 years of service *and* five years in the last permanent grade as colonel for forced retirement of a colonel or brigadier general. If he is given a permanent promotion in the meantime, he will not be eligible to forced retirement until five years later or until he is 60 years of age. In Balchen's case it would be 60 years of age."

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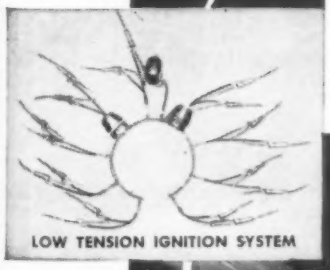

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OTHER PUBLICATIONS . . .

American Aviation Daily, a daily news service for the entire industry. $200 per year. Managing Editor: Keith Saunders.

American Aviation Directory: twice yearly listing of products, people and organizations. $7.50 each. Managing Editor: Marion E. Grambow.

Official Airline Guide: Monthly publication of airline schedules and fares. $13.50 per year in USA; $14.00 in Canada. $15 elsewhere. Published from 139 N. Clark St., Chicago 2, Ill. Central 6-5804. Managing Editor: Robert Parrish.

American Aviation Tariff News (incorporating Air Tariff Reports): Daily rates and tariff news. $1.50 per year. Managing Editor: Wallace I. Longstreth.

When & Where

Nov. 3-29—American University, 7th Air Transportation Institute, Washington, D. C.

Nov. 16-17—American Society for Quality Control, Aircraft Quality Control Conf., Biltmore Hotel, Dayton, O.

Nov. 17-20—Aviation Distributors & Manufacturers Assn., Annual Convention, Broadview Hotel, Wichita, Kansas.

Nov. 19—National Air Taxi Conference, Annual Meeting, Broadview Hotel, Wichita, Kans.

Nov. 19-21—National Aviation Trades Assn., Annual Convention, Broadview Hotel, Wichita, Kans.

Nov. 30-Dec. 1—Fifth Annual Air Cargo Days, American Society of Mechanical Engineers, Annual Meeting, Statler Hotel, New York City.

Dec. 1-2—Frequency Responses Symposium sponsored by the American Society of Mechanical Engineers, Hotel Statler, New York City.

Dec. 3-5—7th annual Arizona Aviation Conference, Yuma, Ariz.

Dec. 17—17th Wright Brothers Lecture (sponsored by IAS), U. S. Chamber of Commerce Auditorium, Washington D. C.

Dec. 17—Wright Brothers Memorial Dinner, sponsored by Aero Club of Washington, Statler Hotel, Washington, D. C.

Apr. 12-14—Airport Operators Council, 7th Annual Meeting, Tampa, Fla.

INTERNATIONAL

Nov. 1-22—IATA, Traffic Conferences, Honolulu.

Nov. 17—ICAO, African-Indian Ocean Regional Air Navigation 2nd Meeting, Santa Cruz, de Tenerife, Canary Islands.

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BRITANNIA DEFENSE

To the Editor:

In the "Industry Spotlight" column of your September 28 issue, you published some curious statements referring to the Britannia airliner.

To state that "the general instability of large airplanes tends to be exaggerated by pure Flettner servo controls" is simply technical wuffle. Stability is a function of shape; size, by itself, does not affect stability, neither does the type of flying controls employed.

So far as the Britannia hunting "in" (shouldn't it be "about"?) all three axes is concerned, we can state only that whilst we have no yardstick with which to measure the acuity of your reporter's vision, he would seem to be possessed of eyesight capable of detecting aberrations of movement which the test instrumentation in the aircraft fails to record.

The Britannia can in fact be flown for lengthy periods "hands and feet off," and we would go so far as to state that:

- **The stick-free stability** is better than that of any other airliner of which we know;
- **The Britannia's control system** is better (in response, accuracy, feel and installed weight) than any other airliner's control system of which we know;
- **Airline pilots** (including American) and official examining pilots who have flown the Britannia, whole heartedly agree with our own test pilots that the aircraft is a delight to fly.

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IS EDUCATION ENOUGH?

To the Editor:

I found the October 12 issue of AMERICAN AVIATION of more than usual interest. It covers a wide field: current problems and future problems, foreign and domestic, military and civil, research and practical applications, etc.

On the subject of structural failures, page 54, the crux of the problems is in the sentence "that at some time a pilot, no matter how careful, who does a lot of cross country work, will inadvertently get into weather." If this is so, then he should know how to handle the problem that will confront him.

If it is only his own safety that is involved, a purely educational program is indicated. But he also becomes a collision hazard to pilots who follow prescribed regulations in instrument weather. If he does jeopardize the safety of others, public interest would seem to require something beyond an educational effort until such time as an automatic collision warning system is in operation, such as Doppler radar.

JEROME LEDERER
Flight Safety Foundation
15 Schuyler St.
New Rochelle, N. Y.

•

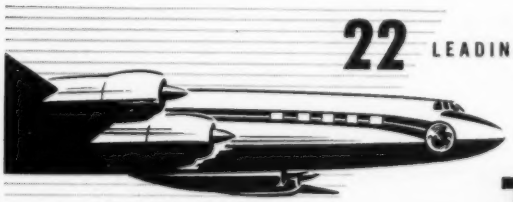
MODIFYING THE C-46

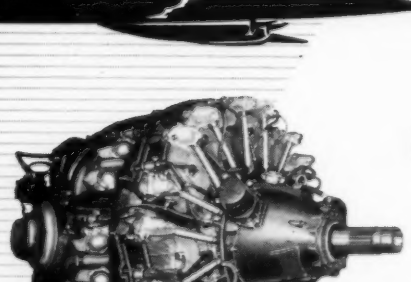
To the Editor:

My September 28 issue of AMERICAN AVIATION arrived yesterday, and I was very much interested in your article on modification of the C-46. We are using two C-46A's over our scheduled air carrier routes for the carriage of freight and mail.

As more fields of suitable length become available, we can demonstrate that there will be a reduction in ton-mile costs by the use of these aircraft, and that is the one hope for reducing costs of transportation that we see in the immediate future. The transport type aircraft (such as the Martin 2-0-2, 4-0-4, or the Convair) are not usable on the soft gravel fields into which we have to operate, nor would they be suitable on fields where there are hard ridges of snow. Under such operating conditions the DC-3 and the C-46 are the best

(*Contd. on page 70*)





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Crossroads for CAB

THERE IS NO USE glossing over the fact that the Civil Aeronautics Board is in trouble. Deep trouble.

Neither is there any use in ignoring the distinct possibility that the five-man agency may be reorganized.

There are no fewer than five public investigations aimed at it. And around Washington it is no secret the FBI was ordered by the White House to conduct an investigation for its own account. The White House staff is concerned about what it has heard and what it has had confirmed.

by W. W. P.

Earlier ideas about patchwork alterations on the Board have been largely abandoned in recent weeks in the light of evidence that a mere alteration or two will not go far enough to eradicate the basic weaknesses which have virtually nullified for some time any semblance of quasi-judicial consideration of air transport's problems.

A solution is not clear. But it would not be illogical to assume that those in a position of authority can reach only the single conclusion that the Civil Aeronautics Act of 1938 remains basically sound but a complete reshuffling of direction is essential.

Meanwhile it is quite ironical that while the prestige of the Board itself has scarcely been lower, the caliber of the first-echelon CAB staff itself has rarely, if ever, been higher. Three recent additions have been excellent. One of these is Ray Sawyer, who moved deftly into the top administrative post as executive director. He is an efficient coordinator. Another is Robert L. Griffith, able and incorruptible, as chief of the office of enforcement.

The other A-1 addition is Mr. Joseph H. Fitzgerald as the new director of the Board's important bureau of air operations, which exerts so much influence over both Board and industry. A Rhodes scholar and a top-notch economist, Mr. Fitzgerald's broad understanding of what constitutes an economically sound industry provides a refreshing new outlook on the staff level.

Despite all of its other difficulties, however, there is one threat to industry and CAB which has been moderated to some extent, at least. As evidenced by his Wings Club speech in September and by other actions and talk, the Under Secretary of Commerce for Transportation, Mr. Robert B. Murray, Jr., was fast setting himself up overnight as an air transport czar and expert who had all the answers at hand.

Perhaps it can be attributed to the warmth and mysticism of the extended Washington Indian Summer this fall, or to the subdued reflections of the Harvest Moon, but somehow or other Mr. Murray has softened considerably in recent weeks.

Whatever the case, Mr. Murray had started running with the ball like mad down the entire length of the field, but just before reaching the goal line he turned his head just enough to realize that no one was following. He had simply failed to hear the whistle stopping the play. Now he seems to be back on the line with the team and it just possibly could come to pass that he'll be carrying the ball with full team support. He might even turn out to be quite a crusader for air transport, in line with his statutory authority.

Control Towers

Giving full marks for his efforts to effect economies in Federal spending, the Under Secretary of Commerce for Transportation, Mr. Robert B. Murray, Jr., has backed down from his earlier decision to pass on to municipalities the costs of operating control towers.

Instead Mr. Murray now proposes to pass on all or most of these costs to the airlines as part of his new user charge proposal now being circulated to industry for consideration and comments. It is not likely that industry will warm up to this latest idea, but at least the tension over Mr. Murray's earlier untenable position has been eased.

No matter how desirable it may be to pass on some of these costs locally (and many cities are quite capable of standing the burden), the fact remains that traffic control at airports cannot be divorced from the Federal airways system. Separating costs would inevitably mean separating jurisdiction of responsibility, an unworkable situation. The very nature of air traffic dictates single control in the interest of public safety. A 500% increase in take-off and landing operations from 1941 to 1952 gives one small measure of the problem.

The truth is that CAA needs to give more attention, not less, to air traffic control. Back in 1938 when the Civil Aeronautics Act was passed, air traffic control was a relatively minor activity. In those days safety and promotion were uppermost in importance. Today the CAA is in the process of returning much responsibility for safety back to industry, while promotional activities are reduced to a minimum. Meanwhile better than 75% of CAA's payroll is attached to Federal airways, and air traffic control has become the biggest and most important job for CAA to perform.

If Mr. Murray intends to continue to plunge headlong into CAA matters, he should give Administrator Fred Lee, who understands the problems,

more support in raising traffic control to a higher level of attention and importance within the Federal airways system. As of today air traffic control is buried far too deeply in the organization structure and the lack of coordination between Federal airways and traffic control in the past has resulted in costly mistakes in the location of new air navigation installations. Here is where some constructive effort is needed.

A much more serious problem, which needs the protective backing of Mr. Murray, is the constant background threat of the military to assume jurisdiction over Federal airways or to establish a separate military system. Such a development would be disastrous in peacetime. And what is all this talk about the Navy's costly (very costly, we hear) efforts to develop new air navigation aids competitive with CAA's own activities? Neatly classified, as might be expected, so that the facts are impossible to obtain.

There's enough to keep Mr. Murray busy *on behalf* of civil aviation, now that the short-lived abortive effort to emasculate air traffic control is past history.

Daydreaming

WRITERS who are far removed from the practical realism of operating airplanes seem to be going overboard on the subject of jet transports with considerable regularity. A British journalist by the name of Stephen King-Hall edits a *National News-Letter* from London and devoted a recent issue to air transport. So completely overwhelmed did he become with jet that he permitted his own judgment to soar even higher than the present world altitude record, as per the following:

"One of the most important results of the spectacular manner in which Great Britain has soared to the top after lying low (like Br'er Rabbit) for five years has been a tremendous growth in the export business. Many foreign lines are still clinging pathetically to piston-engined planes and are not discouraged from doing this by the Americans, but they will have to give in. To travel for example by a Viscount and then by (say) an American piston machine such as the DC-6B used by the Scandinavian line is comparable to the contrast between a luxury car and a lorry."

Lorry is what the British call a truck. When SAS officials read that Mr. King-Hall had called their DC-6B's trucks they all but threw off their traditional cloaks of neutrality and started a war. Actually, Mr. King-Hall was simply carried away on a subject he knows nothing about, such as airline economics. The jet era is here, of course, but it won't see its full blossoming for quite some time. New piston-engined airplanes will continue to be delivered to operators who are more concerned with seat-mile costs and practical flying ranges than with prestige and front page glory. The DC-6B isn't quite an antiquated relic yet, nor will it be for a long time to come.

How Taxes Buy More

Every so often a booklet of exceptional value appears. One such is "Economy in Air Power," the story of the continuing campaign to make the tax dollar buy more airplanes, distributed recently by the Aircraft Industries Association. We hope it gets the readership it deserves. Its message contains some impressive information, such as the fact that a new multiple drill press now used in aircraft manufacturing saves 99.5% of machine time previously required, and that development and use of curved jaws in a stretch forming press enabled savings of $100,000 on one contract. How the aircraft industry is cooperating with government in saving time and money is a story worth telling.

AOPA'S Anticol

In the terminal of the Albuquerque, N. M., Municipal Airport is a forest fire display and a red box which resembles a fire alarm box to be found in every city. A sign says "Open this box to find out how to prevent forest fires." With a come-on like that, almost everyone passing by grabs the bait and opens the box. Inside is nothing but a mirror. The gimmick is very effective.

Similarly effective is a new gimmick just distributed by the Aircraft Owners and Pilots Association. It's a packet of its new anti-collision device, which it has named "Anticol" and all it is, as you may have guessed, is a packet of Kleenex tissues. AOPA is taking the position that most airplane collisions are being caused by the failure of pilots (particularly airline pilots) to watch where they're going, and presumably the tissues are for wiping off the windshields. The idea is both clever and good.

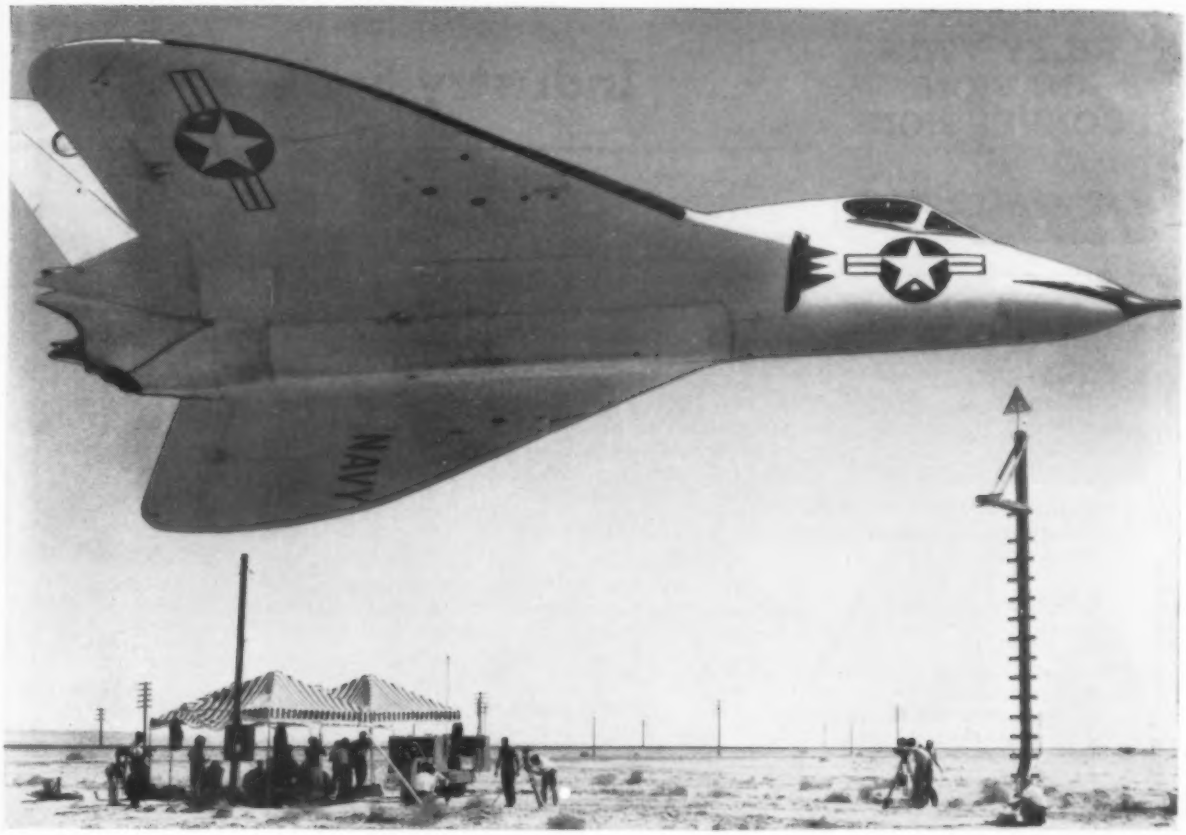
Not all forest fires are caused by human beings, and not all collisions are going to be avoided by cleaning windshields and looking ahead, but the moral of both gimmicks is very much to the point. We trust AOPA has taken into full account in its drive against airline interests, however, that a collision requires two planes.

How Times Change

We don't know whether it's because so many foreign airlines are owned by governments or whether it was just an oversight, but Sir William Hildred in his lengthy annual report last month to the International Air Transport Association of which he is director-general, not once mentioned the word "stockholder," even though most of his report dealt with airline economics.

The investor who has made so much possible in air transport is all but forgotten these days, but it should be pointed out that Mr. Lionel Chevrier, Canada's Minister of Transport, who also addressed the IATA meetings, did mention the responsibility of airlines to stockholders, thus saving the day for those who happen to have put up their money. In fact the listeners were quite highly impressed by the sound, broad outlook toward all air transport problems as expressed by Mr. Chevrier, especially his warnings against the threat of greater bilateral capacity and frequency restrictions. Here is a government official worth watching; he's thinking in the right direction of freedom of the air.

. . . WAYNE W. PARRISH



Westinghouse J 40 powers F4D to world speed record

U. S. Navy establishes new mark of 753.4 mph

A Westinghouse J 40 turbojet powered the Douglas F4D "Skyray" to 761.414 mph as it recaptured the world speed record for the United States by streaking to an official average of 753.4 mph over the required course.

Designed and manufactured by the Westinghouse Aviation Gas Turbine Division in South Philadelphia, Pa., the J 40 and other outstanding turbojets now are being produced at the huge Westinghouse jet engine plant in Kansas City, Mo.

This J 40 contribution to record-breaking jet progress is another example of Westinghouse turbojet leadership. Westinghouse Electric Corporation, Aviation Gas Turbine Division, Lester Branch P. O., Philadelphia 13, Pa. J-54032-A

Official representatives check film of individual passes—746.075, 761.414, 746.053 and 759.499 mph—to determine official average of the Westinghouse powered Douglas F4D.

YOU CAN BE SURE...IF IT'S Westinghouse

150 HP RILEY TWIN NAVION CONVERSION

BY

TEMCO

CASE HISTORY: #811-119-16

CUSTOMER: RILEY AIRCRAFT SALES CORPORATION
Fort Lauderdale, Florida

SHIP: RILEY TWIN N-88N
(Owned by Jack D. Barrett, Sherman, Texas)

RILEY TWIN Navion conversion at TEMCO-Greenville included removal of single engine, all interior furnishings, instrument panel and accessories. Installation of two 150-horsepower Lycoming engines with all-metal, full-feathering Hartzell propellers. Completely new instrument panel; floor-mounted pedestal with throttle, propeller and mixture controls. Reinforcement of center wing section; toe brakes; larger vertical stabilizer and complete new deluxe interior.

First of the new 150-horsepower RILEY TWIN Navion conversions, this more powerful version offers improved twin-engine performance . . . increased speed, smoother handling. These assembly-line conversions are now being performed at TEMCO-Greenville on Navions and 140-horsepower RILEY TWIN's.

Another example of how TEMCO-Greenville is serving executive aircraft owners . . . delivering the greatest aircraft rehabilitation value in the nation. Whatever your needs . . . modification, conversion, complete overhaul . . . TEMCO is equipped, experienced and ready to handle your job.

For full details on this case history and information about TEMCO's complete custom rehabilitation service for multi-engine aircraft, write to:

Herrol Bellomy, Gen. Supt., TEMCO Aircraft Corp., Greenville Overhaul Division, Box 1056, Greenville, Texas

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Industry Spotlight

The new Rolls-Royce turboprop engine, still undesignated, was designed specifically to meet the requirements of Vickers-Armstrongs, Ltd., for a new four-engine turboprop transport. The Vickers transport has been designed around a British European Airways requirement for an 80-passenger short haul transport grossing around 90,000 pounds to handle some of its high density routes. The plane is scheduled to go into service in 1958. The R-R turboprop is reportedly in the 4000-horsepower class.

•

Convair officials have now acknowledged that they are considering, "very seriously," the possibility of getting into the four-engine turboprop aircraft field. This is a reversal of earlier Convair thinking, but the company still intends to maintain its twin-engine developments.

•

USAF designation for the 100,000 pound-payload cargo transport design under development by Douglas Aircraft Company is the XC-132. The twin-boom aircraft grosses approximately 400,000 pounds and has a wheel tread of 100 feet. One variation of the design would be useful as a refueling tanker.

•

USAF descision to use Douglas' Tulsa, Okla., plant as second source for the B-66 light bomber is expected to ease the problem created by the stretchout of Boeing B-47 production at that plant. The B-66, powered by two 9700-pound-thrust Allison J71 engines, is in production at the Douglas Long Beach, Calif., plant.

•

As North American Aviation's board chairman J. H. Kindelberger sees it, the supersonic F-100 has a lot of growth ahead. He sees the F-100 as growing into an even more successful series than the F-86. North American spent more than two million engineering hours in developing the F-100 and over 200,000 hours in aerodynamic testing of eight models, including wind tunnel work in seven wind tunnels.

•

Maximum noise level of transport helicopters should be 70-75 decibels at a distance of 500 feet, according to Eastern Air Lines vice president Charles Froesch in a recent speech before the American Society of Civil Engineers. This is equivalent to the noise level on a busy street.

•

The Civil Reserve Air Fleet, airline and other transport aircraft singled out for military use in case of an emergency, has been augmented by the addition of 14 more aircraft, raising the total from 294 to 308. Another 23 transports have been selected as a contingency reserve to provide replacements for aircraft lost in accidents, through foreign sales, etc.

•

INDUSTRY MISCELLANY

Pratt & Whitney recently shipped the **14,000th Wasp R-4360 engine.** The first was completed in July, 1943 . . . **Canadair** has produced 775 F-86's and 140 T-33's . . . USAF is studying plan to keep **Packard Motor Car Co.** in production on General Electric **J47 engines** . . . **Fokker Industria Aeronautica** in Rio de Janeiro is building 100 S-11 Instructors, 50 S-12's, and 50 S-14 jet trainers . . . USAF has designated the turboprop-powered Boeing C-97 as **the C-137** and the Pratt and Whitney T34 powered Lockheed Constellation as the **C-134** . . . Average cost of the **Boeing B-52's** will run more than **$7 million each** when production is under way—present cost is about $20 million . . . Lockheed has granted a $2.9 million contract for construction of **joint-use facilities** for three major aircraft companies at the USAF's jet center at Palmdale, Calif.

The *Beaver*

THE L20 IN KOREA

In Korea, as in twenty-five other countries in the world, the rugged all metal Beaver has proved of inestimable value to the U.S. Army and U.S. Air Force as an...

Ambulance
Liaison
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Varied missions are routine tasks for the versatile Beavers in service with U.S. Army and U.S. Air Force.

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B.F.Goodrich

Sealed lips hold the secret of faster maintenance

LOCKHEED ENGINEERS were looking for a way to seal the gap between elevator and stabilizer on the P2V-5 "Neptune" for smoother operation of controls. A flap seal—long strip of coated fabric—would do the trick. But an ordinary flap seal poses a maintenance problem. Every time an elevator is taken off for service, the flap seal must be removed too. And with ordinary flap seals, that's a long, costly job.

So Lockheed engineers came to B. F. Goodrich with the problem. And B. F. Goodrich had the answer—the Pressure Sealing Zipper.

The zipper's overlapping rubber lips provide a 100% effective seal against pressure. As a result, the elevator controls are easier to operate. When an elevator is removed, mechanics simply unzip the seal instead of laboriously taking out one screw after another. If a new elevator is installed, old and new halves of the zipper mesh perfectly, since all halves of the zipper are interchangeable. And the zipper makes it easier to get a tight-fitting seal around the hump shown over the man's arm in the photo.

B. F. Goodrich Pressure Sealing Zippers can be cemented onto either fabric or metal. They save space and weight. Fit snugly around complex shapes. Are used on airplane doors, air ducts, inverter covers, watertight protective coverings. For information on construction and applications of Pressure Sealing Zippers, write for our new booklet, "Hold Everything." *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

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ESTABLISHED JUNE 1, 1937

World's Largest Aviation Publishers
American Aviation

VOL. 17, NO. 12

EARLY WARNING radar planes, like this Air Force Super Constellation, form vital part of air defense program.

How Much Air Defense for the Nation?

Joint Chiefs would boost Air Defense Command wings to total of 35, in 137-wing Air Force.

By Robert M. Loebelson

THE National Security Council is about ready to make a decision on one of the most crucial problems facing the U.S. since World War II—a decision which is intimately tied into the future of both the nation and its aircraft industry. The situation—Russia's knowledge of how to build hydrogen bombs—had been expected, but not so quickly after the Soviets first exploded an atomic bomb.

Knowing full well that Georgy Malenkov's air force would be able to deliver both atom and hydrogen weapons by using their long range bombers, the turboprop TuG-75 and Type 31 and the piston-engine Tu-4, President Eisenhower and his NSC colleagues had to call the turn on:

• **Building up the long range** (Boeing B-47 and B-52) bomber fleet to try to deter Soviet aggression through the threat of reprisal;

• **Emphasizing the build-up** of the nation's air defense system through the mass purchase of early warning radar sets, supersonic interceptors, and electronically controlled guided missiles to try to shoot down the Red Air Force bombers.

• **Working out a compromise** between the first two alternatives, because it was obvious that the U.S. could not afford the billions which would have to be expended to have both bombers and radar defenses in satisfactory quantities.

The NSC and the new Joint Chiefs of Staff were aware that they could not afford to gamble on either of the first two options alone. Even after having made the decision to attempt the compromise, however, they were still confronted with how much to ask from Congress in the 1955 budget for bombers and how much to seek for the air defense set-up. One of the NSC's members, Defense Secretary Charles E. Wilson, provided an answer on the preliminary thinking when he declared the budget to be submitted in January would contain a request for about $500 millions for continental air defenses (vs. $600 million in the current fiscal year).

Wilson's figures cover only the radar and electronic devices; the missiles and all-weather interceptors to be ordered would be covered elsewhere in the budget. In essence, however, this is how the USAF's Air Defense Command, which now stands at about 17 wings (only a few equipped with all-weather aircraft) will fare:

• **The 17 wings in existence** are to be modernized and expanded to 29 as planned in both the original 143-wing and the subsequent 120-wing goal. Planes involved will be the North American F-86D, Northrop's F-89D, Lockheed's F-94C, and eventually the supersonic Consolidated Vultee F-102, Republic F-103, and the North American F-100.

• **As a result of the first look** at the

defense picture taken by the JCS, the 120-wing goal has been upped to 127, with six of the wings ending up in the ADC for a new total of 35.

• **If after a subsequent review** (made necessary when the JCS asked NSC to list U.S. commitments in order of priority), the Joint Chiefs should approve the 137 wings being called for by Gen. Nathan F. Twining, USAF Chief of Staff, there would presumably be another increase beyond 35 ADC wings.

By the same token, the Strategic Air Command's long range bomber wings (57 in the 143-wing goal; 52 in the 120-wing force) would be increased to 53 as a result of the new 127-wing target and possibly back to 57 or more if the 137-wing recommendation is approved.

Three Years Later

Although Russia exploded her first nuclear weapon in 1949 and the aircraft capable of carrying A-bombs on round-trips to the U.S. started being delivered to the Soviet Strategic Air Command in quantity two years later, the first detailed report on U.S. air defense needs was not submitted until August 1952.

That study, prepared by the Lincoln Summer Study Group, called for the establishment in five years of a distant early warning line (DEW) along the top of North America near the Arctic Circle. Cost estimate given by Project Lincoln scientists was $1.1 billion, but the Air Force indicated this price was far too low.

Principal USAF objection to the Project Lincoln Report, however, was its feeling that establishment of the DEW line near the Arctic, while it might give several hours advance warning of attack, would not be practical because interceptors now can fly only up to two hours before they require refueling. Thus, the USAF held, we might just as well get the radar line set up at a point where the enemy bombers could be picked up and shot down, i.e., about 600 miles north of U.S. boundaries, and then gradually extend both the early warning and interception line further north.

Some elements of an early warning line do exist at present and are gradually being augmented. Reliable reports indicate there are at least 14 stations fitted with General Electric ASR-2 (airport surveillance radar) equipment across the top of North America and scores of other stations equipped with G-E CPS-6B and Bendix FPS-3 units along both coasts, the Canadian border and the Gulf of Mexico, and the Alaska area.

The Project Lincoln group called for the creation of more radar stations across the top of Canada and on some of the islands between Canada and Greenland.

The findings of the Lincoln group were reviewed early this summer by another set of scientists headed by Dr. Mervin J. Kelly, president of Bell Telephone Laboratories.

The Kelly Report, while not trying to de-emphasize the dangers of Russian bombers carrying atomic and hydrogen bombs and recommending the build-up of radar defenses, pointed out that there is no perfect solution, that some enemy bombers would get through no matter how much was spent on radar equipment and interceptors, and that it would be wiser to stop trying to have the defense net created by some hypothetical date.

"Dollars alone won't solve this problem," the Kelly Report said.

Latest in the series of analyses of the problem of air defense is the one prepared by Lt. Gen. Harold Bull (USA, Ret.), an old friend of President Eisenhower and his wartime chief of plans. Bull, heading a mixed civilian-military group, has drawn up an all-inclusive plan which could be adopted in whole or in part. The Bull Report covers everything, it is said, including means to counteract A-bombs brought into the U.S. by suitcase-carrying saboteurs.

Congress Joins In

Now the Congress is getting into the picture. Sen. Estes Kefauver (D., Tenn.) wrote to Sen. Leverett Saltonstall (R., Mass.), chairman of the Senate Armed Services Committee, urging "prompt hearings" on the air defense question. But Saltonstall replied that the Committee will await the report of Robert C. Sprague, New England industralist, before deciding on the next step.

Sprague, head of the electronics firm bearing his name in North Adams, Mass., was the man President Eisenhower selected to become Under Secretary of the Air Force last February but who eliminated himself by refusing to sell his Sprague Electric stock. His report, requested by the Senate Military Preparedness Subcommittee, is due to be submitted in preliminary form in January.

One new complication in the picture comes from Canada, where scientists of McGill University in Montreal and the Canadian Defense Research Board say they have worked out the "McGill Fence," a device which requires no operator and which reportedly overcomes the limitations of line-of-sight radar. Few details of the McGill concept are available but it is understood that it would throw an electronic beam hundreds of miles, pick up the enemy bombers, and give several hours advance warning at low cost.

As an interim measure, the Air Force and the Navy are planning the establishment of flying DEW lines, in the form of radar-equipped Lockheed Constellations. The Navy's WV-2's and the USAF's RC-121C's and D's are slated for use in the Arctic regions and as patrol craft operating off both coasts to detect enemy planes and give advance warning.

Pentagon Split

But the Pentagon, knowing that the picket Connies cannot do the job alone, is still divided on whether to place the emphasis on bombers or electronics and interceptors. Regardless of the decision, no one will know whether the right option was taken unless or until the Red bombers head for America's industrial and political centers and Gen. Curtis E. Lemay's Strategic Air Command bases, the latter effort to try to forestall retaliation by B-47's, B-36's, and B-52's.

• **Was Gen. Thomas D. White,** AF Vice Chief of Staff, right recently when he said there could be "overemphasis" on air defenses and that the best defense remained the ability to attack with our own long-range bombers?

• **Or did Dr. Lloyd V. Berkner,** a member of the Lincoln Summer Study Group, have the right approach a few days later when he reported a "sure-fire" continental air defense system could be provided for $370 million and an annual outlay of $100 million?

The compromise choice lies with President Eisenhower and his NSC colleagues. • • •

TWA Earns $5.7 Millions

Trans World Airlines has reported earnings of $5,722,586 or $1.72 a share for the nine months ended September 30, a drop of some $611,000 from earnings for the comparable 1952 period. Third-quarter earnings for 1953 were $3,089,390, or 93¢ a share, compared to $4,155,881, or $1.25 a share, in 1952

TWA board chairman Warren Lee Pierson and Ralph S. Damon, president, attributed the lower earnings to "a number of factors," one being an increase of $4,759,000 charged to depreciation in the nine months of 1953 over 1952.

Convair F-102 Makes First Flight

The latest in the USAF's series of supersonic aircraft, Consolidated Vultee's F-102 delta wing interceptor, has made its first flight at Edwards Air Force Base, Calif., with project pilot Richard L. Johnson at the controls.

Convair's F-102 is an outgrowth of the experimental XF-92A, which the San Diego company built for the Air Force in 1948.

Powered by the 10,000-pound-thrust Pratt & Whitney J57-P-11 engine (about 3000 pounds more can be added by the afterburner), the F-102 has been ordered into production as the successor to the USAF's present all-weather interceptors, i.e., the F-86D, F-89D, and F-94C. The J57 will be used in first production models but the Wright J67, not yet in production, is scheduled to be the successor power plant.

ANDB Reorganization Coming Up

A broad reorganization of the Air Navigation Development Board, brought on by civil-military differences over a "Common System" short range navigation system, has been agreed to by Under Secretary of Commerce of Transportation Robert B. Murray, Jr., and Asst. Defense Secretary-R&D, Donald A. Quarles.

Plan will revitalize ANDB prestige by:

• **Upranking of membership** to the level of two-/or three-star generals. CAA Administrator Fred B. Lee will be the Commerce member.

• **Restoration of ANDB chairman,** a post vacant since TWA's Ralph S. Damon resigned in 1951. Post will probably be filled by a civilian close to the subject assigned as a deputy to Quarles.

• **System of pro-rated funding** of ANDB programs. Commerce and three military services will each request funds for allocation to ANDB in lieu of single Commerce appropriation as in the past.

• **Intensification of ANDB activity** on the long range program of air navigation development. This activity was completely stalled by budget cuts in Commerce for fiscal 1954, and was reportedly set for a similar fate for fiscal 1955.

Explaining the move to revamp ANDB, Quarles told AMERICAN AVIATION that, rightly or wrongly, at the outset of the Korean conflict the military became preoccupied with a requirement for a tactical and classified short range navigation system. After recent top level conferences, including participation of the Joint Chiefs of Staff, it has been determined that by properly declassifying certain features of the military system, a "Common System" can be restored. Quarles assured that the completely developed civil VOR-DME system would not be discarded, but that portions of it would be "salvaged." He indicated, however, that he was not ready to say how much would be salvaged.

As to the possibility of military domination of ANDB under the new organization, Quarles indicated that Commerce would still lead the way in implementing the "Common System."

Rental on USAF C-54's Increased to $12,300

The Air Force has notified operators of 37 leased Douglas C-54's that the monthly rental rate of $4821 is being increased to $12,300, with deadline for acceptance of new lease agreements set at late last month. New USAF terms also require operators to set up an aircraft maintenance reserve fund.

Initial industry reaction has been that contemplated Air Force fee is too high, but most operators indicate they will probably accept the new terms, at least for a short time, until they review the overall aircraft equipment situation.

Largest operator of leased C-54's, Pan American World Airways, reported that it will retain those aircraft assigned to the Pacific airlift as long as this operation continues, but that others not so engaged would be returned to the Air Force as soon as DC-6B's on order are delivered.

Overseas National Airways, operating four of the leased airplanes, filed suit in District Court in Washington, D. C. to enjoin AF Secretary Talbott from increasing the rental fee. ONA's claim was related to a 1946 Appellate Court decision that some 33 aircraft should be sold to veterans. George W. Tompkins, Overseas National president, has taken the position that the current leases with the government, set to expire on December 31, 1954, are valid, "and since the government now seeks to confiscate the planes by unilaterally increasing the rental to over $12,300 per month, we think we should be entitled to enforce the original [Appellate Court] stipulation."

More Connies Ordered

Lockheed Aircraft Corp. has had a net increase of eight-aircraft in its commercial backlog for Wright Turbo-Compound-powered Super Constellations.

• **Eastern Air Lines,** which increased its order for L-1049C's from 16 to 22 in April, cancelled the six extra planes which were to have been delivered beginning in the fall of 1954. Reason: Revision of its equipment needs based on future traffic estimates. Loss to Lockheed: $12 million.

• **Trans World Airlines** upped its order for L-1049E's from eight to 20, all to be delivered between February and June, 1955. All 20 will be fitted with Dreyfuss-designed luxury interiors. Cost of the 20 Super Connies, including spares: $45 million.

• **Compania Cubana de Aviacion, S. A.,** signed a contract for the purchase of two L-1049E's. Cost, including spares: $3.5 million.

Basis for User Charges

Estimates Based on Use in Continental U. S.

Fiscal Year 1952

Terminal Aids	Total Cost (Dollars)	Basis of Allocation	Air Carriers (Per cent)	Other Civil (Per cent)	Military (Per cent)
Control towers	13,204,342	Aircraft operations	28.4	54.4	17.2
Approach light lanes	922,797	Instrument approaches	78.4	6.0	15.6
Fan markers	280,587	Instrument approaches	78.4	6.0	15.6
Instrument landing systems	3,570,450	ILS approaches	93.0	4.0	3.0
Precision approach radar	1,012,398	PAR approaches	58.4	11.2	30.4
Airport surveillance radar	1,763,104	Aircraft operations at ASR airports	56.9	33.7	9.4
Homing facilities	268,095	Instrument approaches	78.4	6.0	15.6
Combined station towers	1,558,539	Aircraft operations	28.4	54.4	17.2
Subtotal	22,580,312		45.4	39.7	14.8
Enroute Aids					
Traffic control centers	12,208,841	Fix postings	61.5	8.3	30.2
Communications stations	24,473,641	Air-ground radio contacts	10.0	35.8	54.2
Light beacons	1,326,069	Air-ground radio contacts	10.0	35.8	54.2
Intermediate fields	752,469	Fix postings	61.5	8.3	30.2
Fan markers	696,049	Fix postings	61.5	8.3	30.2
Homing facilities	974,229	Fix postings	61.5	8.3	30.2
L/MF ranges	4,894,055	Fix postings	61.5	8.3	30.2
VHF Ranges	6,741,550	Fix postings	61.5	8.3	30.2
Distance measuring equipment	1,045,876	Fix postings	61.5	8.3	30.2
Subtotal	53,112,779		36.5	21.7	41.9
TOTAL	75,693,091		39.2	27.0	33.8

User Charges Proposed for July, 1954

The CAA has proposed that user charges for domestic airways be established July 1, 1954, and that the first phase of the program be designed to recover $25 million yearly from civil users through a 2½¢ gas tax. The $25 million represents one-third of total annual airways costs, the report said, hinting that charges may be higher in future years.

The report is being circulated to government agencies and interested parties for comment. It is subject to revision after receipt of comment, and the final document is expected to be the basis for recommended legislation. The Air Transport Association immediately branded the proposed charges as "onerous and excessive."

The 2½¢ tax would be in addition to the present 2¢ gas tax. If this method of collection is not found acceptable, the following is proposed: planes with maximum gross take-off weights of over 4500 pounds would pay one mill per gross ton-mile flown. Under 4500 pounds this charge would not apply, but annual license fees would be levied: 0-1500 pounds $10 per plane; 1501-2500 pounds $25; 2501-4500 pounds $50.

The report said annual cost of domestic airways system was $75,692,993 in fiscal 1952, including depreciation of capital investment, research and development cost, maintenance and operation, and management and overhead.

Estimated allocation of cost responsibility to three major user groups, including use made and economic value derived, was: scheduled airlines, $38,416,463, or 50.7%; other civil planes, $11,695,258, or 15.5%; military users, $25,581,370, or 33.8%.

National Airlines president G. T. Baker looks down from the cockpit of a Sikorsky S-55 as NAL becomes first major U. S. trunk line to try helicopters.

Fairchild to Begin Campaign on F.27

Fairchild Engine & Airplane Corp. will begin a campaign to sell the Fokker F.27 as a replacement for the Douglas DC-3 to the nation's 14 local service airlines after the first of the year.

As a further step, Fairchild president Richard S. Boutelle told AMERICAN AVIATION, the Hagerstown, Md., firm will probably purchase and bring to the U.S. for demonstration the first of two F.27 prototypes which Fokker Aircraft Co. is building for the Dutch.

The Fairchild president said Fokker's break-even point on the high-wing DC-3 replacement was 65 planes selling at $450,000 each. First deliveries, he added, could probably be made to U.S. local service lines in 1956 by Fokker. Capacity of the Fokker plant at Amsterdam was given at up to 150 aircraft. Boutelle indicated that if orders climbed much above that the F.27 would also go into production at Hagerstown.

If local service lines buy the Dutch plane, Boutelle declared, any required fuselage maintenance work would be handled at Hagerstown and servicing of the British Rolls-Royce Dart RDa.5 turboprop engines and Rotol propellers would be taken care of by Fairchild's Engine Division on Long Island.

Strike Hits North American Plants

More than 33,000 North American Aviation workers at Los Angeles, Fresno, and Columbus, members of the United Auto Workers-CIO, went out on strike October 22 to back up union demands for a blanket pay boost of 23.4¢ an hour. There was a possibility that AFL-Machinists working for other West Coast plane builders might also stage walkouts.

NAA offered four per cent (6-10 cents an hour) plus other money benefits.

With production of F-86F, D, and H Sabrejets and F-100's and T-28B's shut down for what the union, the company, and Federal mediators expected to be a "long" period, attention focused on International Association of Machinists negotiations with other companies, especially since IAM locals had pledged the UAW support.

Douglas's contracts with the IAM at Santa Monica and El Segundo expired October 17 but were extended until November 1. Douglas has offered five cents an hour; the IAM is seeking 10%.

Cook Appointment May End AMC Friction

Overlapping between agencies due for elimination; Deputy Chief declares he intends no radical changes.

By Harry S. Baer, Jr.

LENDING SUBSTANCE to the grumbles which have been coming from the aircraft industry for some time now, the Air Force has finally acknowledged officially that all is not well between the Air Materiel Command and the Air Research and Development Command.

The admission came as AF Secretary Harold E. Talbott selected Lt. Gen. Orval Ray Cook to reign over AMC and ARDC. Talbott can now call on one man for research, development, procurement, and production answers.

This additional chore for Cook, who retains his title as Deputy Chief of Staff/Materiel (a post he has held since July, 1951), is bound to pose some knotty problems. There's more to it than just determining where research and development end and production and procurement pick up. Talbott said that "drawing the line" between these areas would be Cook's principal task in cutting out the overlap of functions between the commands.

"We know of no such yardstick for determining this now," Cook told us, "but we'll be working hard to find one. I don't expect to find this new responsibility insuperable. Anything we do will be gradually applied and will be in the form of refinements and improvements of what we're doing today. I have no plans now for any major, radical change."

Aside from finding a line of demarcation between AMC and ARDC, Cook has become a marked man. He has to face up to a vociferous aircraft industry, a great segment of which is dissatisfied with the present arrangement. Since April 2, 1951, when ARDC evolved out of AMC as a major AF command, the industry has been confronted with a number of noteworthy problems.

Perhaps one of the most basic, practical ones is industry's current effort to get its job done with the two commands geographically and philosophically separated. One manufacturer said it was like "batting a badminton bird back and forth from Baltimore to Dayton to Washington." A staggering amount of paper has been making the round robin with comparatively few concrete decisions resulting, he noted.

More fundamentally, though, AF R&D efforts as a separate unit have brought charges from some circles that

Cook

Craigie

(1) too many dollars that would have gone to industry are being consumed by technical men in uniform; (2) industry has less incentive to think up new ideas; (3) instead of a partner to the AF, industry has been relegated to "servant status"; and (4) lack of liaison between the commands has plagued the industry with delays.

Thus Cook is not in an enviable position, being earmarked as the man with the last word in resolving AMC-ARDC differences. His selection in one respect can be considered a vote of confidence for ARDC. It indicates the AF hierarchy is making an effort to keep the command operating separately, despite certain pressures to filter it back to Dayton.

On the other hand, selection of Cook seems to give AMC a solid edge. As DCS/Materiel for the past two years, Cook could well be pro-procurement. Had Lt. Gen. Laurence Cardee Craigie, Deputy Chief of Staff/Development since November, 1951, been selected for the hot spot, ARDC could well have felt it had made its mark.

Although both generals retain their present titles in this staff level responsibility change, Craigie has become subordinate to Cook. His scope is to include "research and initial phases of development." Whenever there is an organizational switch on this high level, it stirs up a lot of talk, and the personalities and records of the key figures involved are critically analyzed. It's always interesting to hear what the lower man on the totem pole has to say.

"The change may appear as subordinating R&D to some extent, but we're not particularly concerned about this aspect," Craigie told us. "ARDC and AMC must work as closely together as possible. If they don't, they're headed for trouble."

Craigie feels that Talbott's plan with Cook at the helm will work out. He said that with two organizations to be satisfied it had been hard to arrive at precise decisions and that certain compromises had to be made. He noted that the air secretary had made the switch in staff level responsibility "to smooth out a very complicated situation."

"I do not feel this change will put us in a position where we can't do our job, and I'm certain ARDC will not be affected to the point where it can't do its job," he emphasized.

Craigie expressed satisfaction with the accomplishments of ARDC to date, saying the young command "has made a lot of progress." He is not alone in his feelings. A number of key members in the aircraft industry, although concerned about excess haggling required to get a job done, have been favorably impressed by ARDC's efforts to make the present system work. They have high regard regard for the R&D team at Baltimore and the competence of its leaders.

The nod to Cook to smooth out AMC-ARDC working relations is no reflection on Craigie. Although their military careers have followed somewhat parallel courses, the 55-year-old Cook is senior to the 51-year-old Craigie in more respects than age. The former received his three stars July 28, 1951, the latter on July 5, 1952. Cook graduated from West Point in 1922, a year ahead of Craigie.

"Of all people in the Air Force, General Cook, by virtue of his R&D and production experience, has the best background for coordinating the two commands," Craigie said. "He's much too objective to put one command before the other." • • •

Northrop Record Backlog

A record backlog of unfilled orders totaling $508,000,000 as of July 31 is reported in Northrop Aircraft's report for the fiscal year ended that date. Oliver P. Echols, president, announces that additional contracts amounting to $167,000,000 are currently under negotiation.

Northrop earned $3,360,516 (including a $1,022,157 tax credit) or $5.23 a share in the 12-month period ended July 31, vs. a net of $2,420,605 or $4.22 a share for the previous year. Consolidated sales and other income for Northrop and its subsidiary, Radioplane Co., were $184,230,018 for the fiscal year ended this summer. Sales were the second highest on record.

Saga of the C-123B: Production at Last

Turbulent history of the assault transport reaches climax as Fairchild Corp. gets USAF order.

WHEN Fairchild C-123B assault transports roll off the Hagerstown production line late next year, one of the longest and most hectic Air Force contractural efforts will have reached a climax.

The planes will be patterned almost exactly after a model that was airborne four years ago—the Chase-designed XC-123. By the time production starts, five years will have elapsed since the plane first flew.

Even so, the "123"—which has been dubbed the "Avitruc"—will be a new aircraft, representing a victorious effort by the Army to obtain a modern assault transport.

10% Lower Bid

Most recent highlight in the transport's controversial existence was the AF nod to Fairchild Engine & Airplane Corp. to built 165 Avitrucs. The Maryland firm has set next June as the target date for the Fairchild prototype. The new contract, a fixed-price agreement more than 10% lower than any other bidder's, should keep the company busy through about the middle of 1956. Full C-123B production is expected by January, 1955.

An assortment of reasons will have caused nearly a decade to go by before Avitrucs will have become a part of U. S. airpower. The plane with the box-like configuration was first conceived by the Army Air Force just after World War II, but obstacles and delays in reaching the production stage have been great. Both Pentagon pressures and contractor difficulties have plagued the mass building of C-123B's.

The Army Air Force became interested in replacing combat gliders with power aircraft soon after the war. Hedgerow landings at Normandy, though successful, had shown that the glider was too much of a parasite in assault operations, so the military began thinking about a sky vehicle that could get around on its own.

Recognizing their obligation to the infantry, air officials collaborated with ground officials and developed an idea for an assault transport based on a "box concept." Their initial design work emphasized a fuselage which would be ideal for troops.

Their planning became Air Materiel Command Engineering Division Design No. 555. It resulted in the building of the XG-20 glider, a 16,000-pound capacity carrier, which was produced by Chase Aircraft Co., Inc., West Trenton, N. J., then headed by Michael Stroukoff, an instrumental figure in the aviation design. Soon engines (two Pratt & Whitney R-2800's) were added and the glider, before it was even flown as a glider, was transformed into an airplane designated the XC-123.

A rugged aircraft, one that could withstand rough terrain landings, was a primary consideration in the Avitruc's makeup.

The XC-123 proved its ruggedness from the very start. The day before its "first flight date" of October 12, 1949, Air Force and Chase people sneaked a flight which went off without a hitch. But the official flight demonstration viewed by military brass was different.

The takeoff and aerial performance went along smoothly. But the assault transport developed a brake malfunction on landing. This caused a tire to blow out, and the plane ground looped almost immediately after touching the ground. Damage was slight, with only a wing tip and a propeller brushed.

A Troop Carrier Command flight officer present, impressed by the way the XC-123 withstood the unexpected incident, commented, "Any plane that can take a ground loop like that is our plane."

One in Existence

There is now only one Avitruc in existence. It currently has been undergoing Phase II testing, similar to commercial airworthiness tests, at the AF Flight Test Center, Edwards AFB, Cal. Soon it will be sent to Hagerstown, where Fairchild engineers can look it over closely before starting production.

The XC-123 won the design competition and was chosen as the most desired Army assault transport during tests in August-September, 1951, at Elgin AFB. The present C-123B, a production version of which made its first flight in April this year, is an almost exact replica of the XC-123 with the exception of minor changes in the rudder configuration, addition of thermal deicing equipment for the wings, increased weight, and later versions of the Pratt & Whitney R-2800 engines.

The fact that the Avitruc's construction characteristics have been designed for the infantryman, not for sleek looks, is emphasized by Lt. Col. Floyd Sweet, XC-123 project officer from 1946 to 1951.

"The XC-123 was unique in having one of the first of standardized cockpits," Sweet adds. "Here various flight instruments have been segregated to make their use easier on the pilot in line with aero-medical research on eye fixation. Electric switches, radio controls, circuit breaker switches, emergency flight controls, and engine instruments are grouped on the panel. The plane was also one of the first to use the Westinghouse Decelostat to prevent wheels from skidding."

Getting the C-123B to where it is today has been a long, controversial haul. Although the ground forces fought hard for the Avitruc, many air officials in the Pentagon were hard to convince.

Limited Facilities

Another reason for the slow pace was the limited production facilities of the Chase Aircraft Co. at West Trenton. To accommodate C-123B production, they would have to have been enlarged considerably, and this would have taken much more time.

The resultant merger of Chase with the former Kaiser Manufacturing Corp. in September, 1951, initially appeared to provide a suitable home for C-123B production. It would have been at Kaiser's huge Willow Run, Mich., plant which up to this summer was nearly tooled-up for Avitruc production. Three planes were near completion.

Due to the differences that arose between Kaiser and Stroukoff, plus Kaiser's difficulties in Congressional circles as a result of C-119 production costs at Willow Run, the AF abruptly terminated all Kaiser aircraft contracts this summer, leaving the C-123B without a production site and an aircraft manufacturer to do the work.

After all the bills come in, the cost of cancelling the 165 Avitrucs at Kaiser is likely to run between $115 and $140 million. Thus the assault transports will be anything but cheap over the long run. When Kaiser started tooling up for the planes, the AF had in mind building 244. But later the figure was reduced to 165, with a cost estimate for this number given as $276,335,000.

With the door wide open for a new home for the C-123B, the AF called for bids in August. Though Fairchild wasn't invited to bid, it requested and received permission to do so just before the closing date. The Hagerstown firm offered a fixed price more than 10% lower than Consolidated Vultee Aircraft Corp's. and won the contract. The AF now is apparently getting the plane built for a rock-bottom figure. • • •

A. E. Summerfield

John C. Allen

Alfred P. Graham

Earl Wadsworth

Three-Cent Mail by Air Runs Like Clockwork

First two weeks of experiment see 373 tons carried, none refused; other accomplishments to credit of PO.

By Eric Bramley

THE "REVOLUTION" of October 6, 1953—the experimental start of first-class mail by air—was one of the quietest on record.

The four scheduled airlines participating on the New York-Chicago and Washington-Chicago routes started hauling the 3¢ letters as if they'd been doing it for years. There were no hitches. The carriers were handling all the first-class mail offered to them; none was turned back to the railroads.

In the two weeks American, TWA, United, and Capital flew 372.8 tons. Their revenue would amount to about $50,000. They had carried 26 million letters.

Although it was a quiet revolution, from a public standpoint the first-class mail scheme was one of the most spectacular accomplishments of the new Republican leadership in the Post Office Department, headed by Postmaster General Arthur E. Summerfield. As far as the airline industry is concerned, the new thinking in the PO, the other accomplishments, and the probable future plans, are equally spectacular.

Summerfield is operating the PO on what amounts to a six-word edict from the White House: "Better service, less cost, reduced deficit." It is well for the industry to remember that Summerfield's top air mail aides follow this to the letter.

The three major accomplishments made to date under Summerfield's guidance:

• **First-class mail by air experiments.** Summerfield has revealed that the experiment will be extended to the Pacific coast between Los Angeles, San Francisco, Portland and Seattle about the first of the year.

• **Separation of airlines' service pay from subsidy**—a move in which the PO played a large part—and shifting of subsidy payments from the PO to the Civil Aeronautics Board;

• **Reorganization of the PO's air mail branch**—the naming of a new director of air service and elimination of 15 assistant general superintendents for air mail. (As Summerfield has stated, the PO is "removing excessive layers of supervision and revitalizing administrative operations.")

ARTHUR ELLSWORTH SUMMERFIELD, shown in the center of our cover photo this issue, has been the center of some of the fastest moving events in the history of the Post Office since he became Postmaster General on January 20, 1953. This photo, taken during the October 6 ceremonies which marked the start of the first-class-mail-by-air experiment, is symbolic of the manner in which Summerfield has become the pivot point of the PO's stepped-up activities.

Born on March 17, 1899, in Pinconning, Mich., Summerfield has had a successful business career in Michigan in real estate, oil distribution, as automotive distributor and as vice-chairman of the National Automobile Dealers Association. Active in the Republican party for years, he served as chairman of the Republican National Committee From July 12, 1952, until his appointment as Postmaster General.

Shown with Summerfield, left to right, are the presidents of the four airlines taking part in the initial experiment: J. H. Carmichael, Capital Airlines; Ralph S. Damon, Trans World Airlines; C. R. Smith, American Airlines; and W. A. Patterson, United Air Lines.

In line with the "better service, less cost, reduced deficit" mandate are three less apparent but equally newsworthy developments:

• **PO has started bulk weighing** of air mail, instead of weighing each pouch, eliminating unnecessary bookkeeping and getting mail on planes faster;

• **Airlines can transfer mail** on the ramp, instead of taking it to post offices for transfer, thus speeding delivery;

• **It is experimenting with nylon mail bags;** if adopted, their lighter weight will save $800,000 a year in transportation costs.

Airlines were not satisfied with what they considered the low pay scale established for first-class mail—18.6¢ per ton-mile New York-Chicago and 20.04¢ Washington-Chicago. The PO contended that it could not pay more than it cost to haul the same mail by rail, and that the rates were reasonable because they applied to space that would otherwise be unused. Airlines maintained that no consideration was given in setting the rates to what it would cost them to carry this mail.

Early acceptance of the rates by one carrier (United) plus the fact that nonscheduled and freight lines were clamoring to participate in the experiments, resulted in establishment of the PO-proposed scale. There are those who insist that the PO would have paid more had the carriers presented a united front.

Despite the fact that they disagreed on details, airline officials have praised Summerfield for putting first-class mail in the air despite opposition of railroads and rail and postal unions (over 100 postal clerks have been removed from railway mail cars since start of the experiment). The plan had been talked for years, but there had never been any

real action.

With transfer of subsidy payments to CAB, the PO cut a respectable sum from its deficit—$80 million in the next fiscal year. Air mail will now return it a profit. Had separation been in effect in fiscal 1952, for example, the PO's domestic air mail profit would have been $9.7 million and the international $3.8 million, after all charges. Future profits will be considerably higher.

Reorganization of the air mail branch was carried out by John C. Allen, Summerfield's choice for Assistant Postmaster General-Transportation. Allen, the first man with an industrial traffic manager's background (Sears, Roebuck) to hold this job, has brought business-like methods to the transportation division of the Department (one of his first actions was to stop fining airlines for mishandling mail—"That's not the American way of transacting business"). His executive assistant, with a similar background (Boeing Airplane Co.) is Alfred P. Graham.

First reorganization step was naming of able, energetic Earl Wadsworth as Director of Air Service. Wadsworth has been with the PO since 1916, except for military leave. Next came elimination of the assistant general superintendents for air in each of the PO's 15 divisional offices. They have been replaced by three regional directors (eastern, central, and western) reporting to Wadsworth. Results: economies and a streamlining of functions.

In one attempt to cut costs, the PO made a move that backfired: it reduced the amount of U. S. mail it was giving to foreign airlines for transportation.

PO officials explained that policy has always been to give mail to foreign carriers where delivery would be expedited. They claimed, however, that this policy was not being followed—that such carriers were, in some cases, also receiving mail that would not be expedited. This has been eliminated (the U. S. can send the mail at less expense on its own lines). Where reciprocal mail agreements exist (with Britain, France and Scandinavia) there have been no cuts.

However, when the PO reduced mail to certain foreign lines, their governments cut the volume given to U. S. carriers, one of whom has suffered a drop of $50,000 monthly in foreign mail revenue. The entire problem of using foreign lines, reciprocal agreements, etc., is now being studied by the PO.

On the other hand, the PO is trying to help U. S. lines increase their foreign mail loads from three countries—Egypt, Greece and Turkey. It has reduced the rate which TWA and Pan American must receive for such mail, so that it is directly competitive with the rate these countries can obtain by using other airlines. It is probable that this rate reduction will spread to other European nations.

Here's the outlook on future PO actions:

• **Extension of first-class mail:** Summerfield has said, cautiously, that if the present experiment continues to work out satisfactorily, "this speedier service will be extended on a national basis."

Although no other PO official wants to be quoted, it's a foregone conclusion that the 3¢ mail plan will spread. Eventually, it's likely that all such mail traveling over a certain distance will fly. PO faces one difficulty: it doesn't want to have to study and survey each U. S. route in order to establish mail pay scales (as it did with the two experimental routes). One possibility: a proposal that airlines carry first-class mail under cargo tariffs.

• **International first-class mail:** This has already received some PO consideration and will be studied further. It's a definite possibility, at least on a few routes.

• **Local service:** PO will probably favor extension of first-class mail experiment to some segments of some local service routes (carriers' proposal is 45¢ per ton-mile).

• **Non-scheduled carriers:** Whether or not irregulars and certificated freight operators are permitted to participate in experiments is being left to CAB. PO has expressed no formal opinion. Privately, some officials think they should participate.

• **Service pay:** PO isn't convinced that some service rates are at the right level. It can't be said that officials hold hard and fast opinions yet, but they're wondering whether mail should cost more than coach passengers and whether it should be much higher than cargo.

• **45¢ vs 53¢:** It's a good bet that there'll be early action on this problem through CAB proceedings. PO doesn't think it can continue to justify giving mail to a 53¢-a-ton-mile carrier when a 45¢ carrier is operating over the same route.

• **Helicopters:** Outlook is considerably brighter than it was six months ago, when trend was toward reduced operations. Reason is subsidy separation; PO no longer has to foot the entire bill (service rate is $2.58 a ton-mile, with annual subsidy of $2.3 million for all operators). PO is currently conducting tests over some of New York Airways' routes to determine comparative cost of carrying mail by helicopter and by surface transport.

• **Negotiated rates:** There's still some feeling that CAB should set a mail rate level from which PO would be permitted to negotiate—mostly downward, sometimes upward. Whether this point will be pressed remains to be seen.

• **Seven cent air mail:** Summerfield, intent on wiping out as much of his deficit as possible, can be expected to renew his fight to raise air mail postage to 7¢, along with increases in other rates.

An industry official who has had numerous dealings with the PO said recently: "The Republicans can probably point to more accomplishments in the Post Office than in any other department. We won't always agree with Summerfield; we may get hit where it hurts. But you know where you stand when you deal with him. He's one of the most able men in government today."

• • •

News Briefs

Argument over whether the CAB can **approve non-mail-carrying lines** for three-cent-mail flights continues, with the Post Office maintaining that the Board possesses the authority to grant the necessary exemptions. American Airlines holds that it does not, and that even if it did it would not be authorized to set mail rates for such carriers.

•

First exploratory meeting of the **Interdepartmental Aviation Manpower Committee** has been held, and plans are for monthly sessions hereafter. Members include representatives from Government departments, CAB, and Selective Service.

•

C. R. Speers, assistant vice president and general sales manager of American Airlines, has been elected **president of the Air Traffic Conference** for the coming year, succeeding Harding Lawrence, vice president of traffic for Pioneer Air Lines.

•

Douglas Aircraft has reported a nine-month net of $13.3 million for the period ended August 31. In the same nine months United Aircraft **Products** reportedly earned $230,385. Thompson Products, for the nine months ended September 30, reports a record net of $7.5 million.

•

Doman Helicopters announces that word will be forthcoming "shortly" on its merger or licensing negotiations with "a number of manufacturing concerns." Desire for facilities for development of a large transport helicopter was cited by president Glidden S. Doman as major reason for projected affiliation with larger firm.

Enlist

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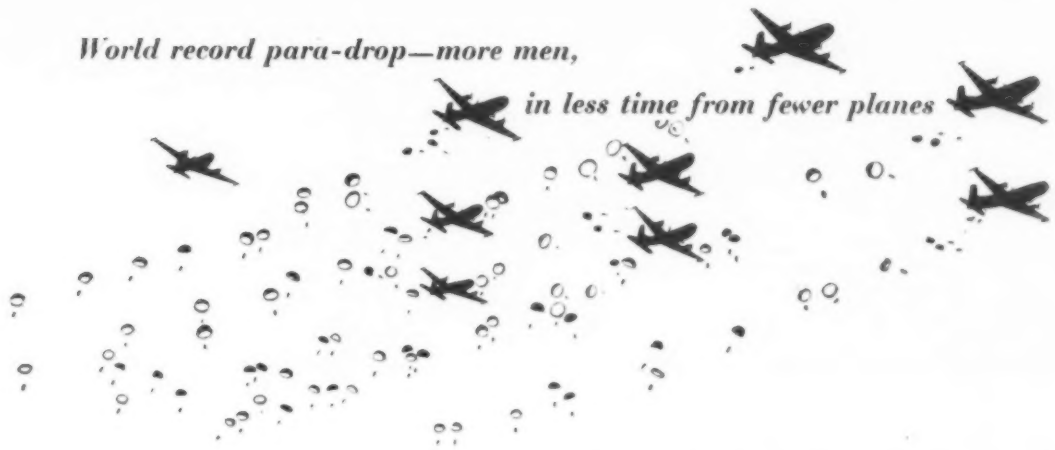


with the—**Douglas C-124 Globemaster**

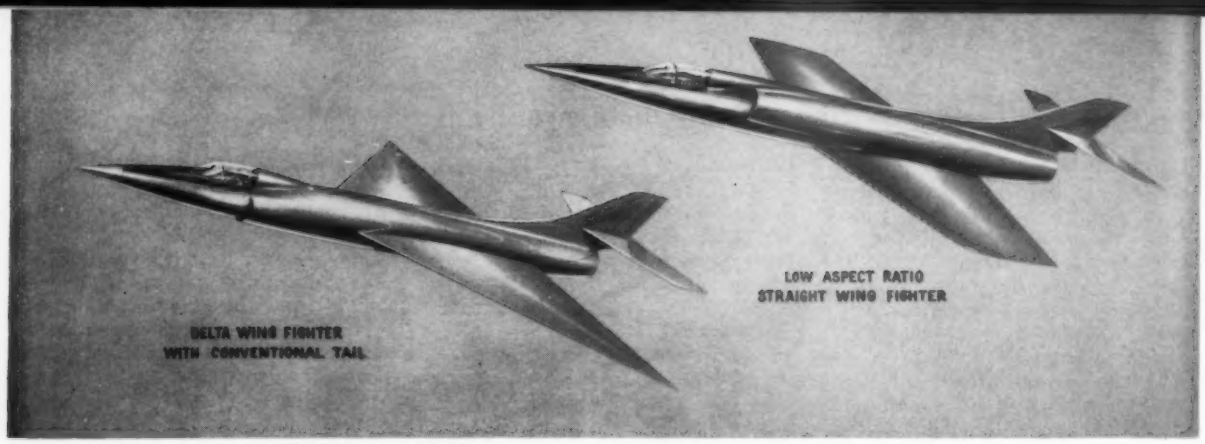
Nine Douglas C-124 Globemasters of the 18th Air Force, 62nd Group, 7th Squadron, cruised above Fort Bragg. Seconds later, more than a thousand paratroopers had hit the silk... were floating down on the drop zone.

For this record-breaking drop, Globemaster—the Air Force's largest operational transport plane—was a logical choice. Clamshell doors, located in the nose, make loading of troops or matériel fast and easy. Load space is two stories high... gross weight at take-off, 87½ tons. A single Globemaster can transport 200 armed troops across the Atlantic—deliver 25-ton loads of tanks, cranes, loaded trucks to fill immediate needs at bases anywhere in the world.

Performance of the C-124 Globemaster is another example of Douglas leadership in aviation. Planes that can be produced in quantity to fly *faster and farther with a bigger payload* is a basic rule of Douglas design.

Enlist to fly in the U. S. Air Force

Depend on *DOUGLAS* **First in Aviation**



"THERE IS NOTHING aerodynamically good about low aspect ratio."

A Critical Look at Supersonic Wing Design

Deltas have no monopoly on advantages of low-aspect-ratio wings, says Lockheed engineer.

By WILLIAM D. PERREAULT

LATE LAST MONTH the U. S. Air Force took delivery on the first production model supersonic fighter, the swept-wing North American F-100. At the same time the supersonic F-102, Convair's delta-wing fighter, made its first flight. These events will be followed in short order by first flights of other aircraft in the USAF's stable of upcoming supersonic fighters: the swept-wing McDonnell F-101, swept-wing Republic F-103, straight-wing Lockheed F-104, and delta-wing Republic F-105.

Each of these types is supersonic in level flight. Two are production aircraft and a third is likely to see production. The latest production model heavy bomber is the swept-wing Boeing B-52, but Convair already has under way a prototype delta-wing bomber of the supersonic class, the XB-58.

It is readily apparent that the USAF is not ready to single out one particular wing plan form as its choice for supersonic fighters, or for that matter for its bombers.

As chief engineer of Lockheed Aircraft Corp., which has a production contract for the straight-wing F-104, Clarence L. "Kelly" Johnson is not so undecided. Appearing before the National Aeronautic Meeting of the Society of Automotive Engineers in Los Angeles recently, Johnson said:

• **Lockheed designed** and started to build a delta-wing aircraft several years ago, but abandoned the project on the basis of wind tunnel tests which disclosed major stability problems inherent in delta designs and because of final weight figures.

• **Delta-wing aircraft** have flown "almost entirely in the subsonic speed range" and ". . . and few have reached speeds obtained by service aircraft."

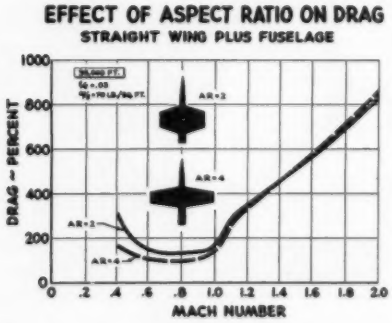
• **Deltas have "no patent"** on the characteristics of low-aspect-ratio wings, such as the structural advantages and low thickness/chord ratios. The straight low-aspect-ratio wing is equally good in these areas, while showing advantages in lift and stability.

• **Reference to deltas** as "tailless" aircraft is a misnomer—extremely large vertical surfaces of delta type aircraft (see tables) often result in greater total wing and tail surface areas than conventional aircraft.

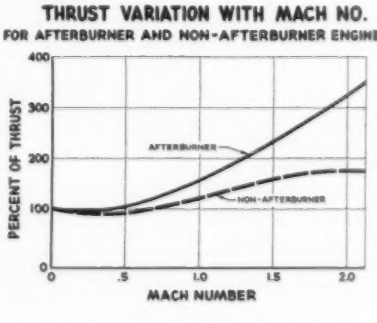
• **A major error exists** in considering wing areas without considering maximum lift and drag at high angles of attack or the low usable maximum lifts during take-off and landing.

In laying the ground for his discussion, in the paper titled "Airplane Configurations for High Speed Flight," Johnson went into a discussion of various powerplants available for supersonic flight as well as wing plan forms. His principal conclusion: Despite its noise, complexity, and fuel appetite, the afterburner engine is "here to stay" because it is the most practical engine for obtaining supersonic level flight.

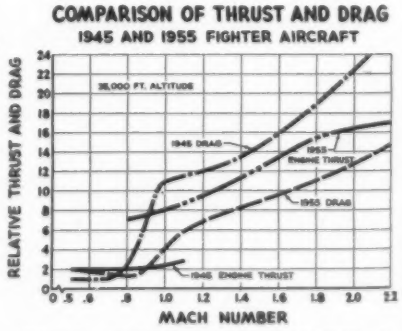
Johnson ruled out the ramjet engine "for some time to come," except in the role of an afterburner, because of its narrow speed range. The best reason for looking to the afterburner jet engine for supersonic flight is apparent in performance curves at high



BOTH OF ABOVE wing configurations for supersonic fighters are more satisfactory than conventional delta, according to Johnson, Lockheed's chief engineer.



AT MACH 2 the afterburning engine develops 320% of its static thrust, compared with 180% for the non-afterburning type of jet engine.



BOTH AIRCRAFT AND ENGINE designers have contributed to improvements closing gap between power available and power required by supersonic fighters.

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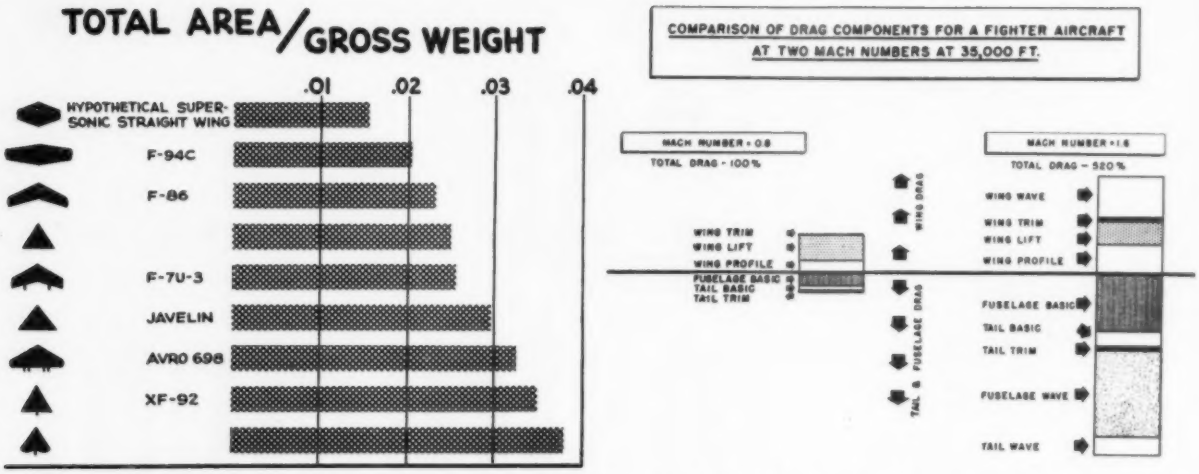


RELATIONSHIP OF WING FORM and relative area per unit of gross weight is reflected in this Lockheed comparison. Note relative drag of different components at subsonic and supersonic speeds.

speed. At Mach 2 (see graph) the afterburner engine thrust is up to 320% of its static thrust level, while the non-afterburning engine is only 180%. The former is also smaller in diameter and engine weight is about 25% less, Johnson claims.

Johnson pointed out the aerodynamic and engine power limitations which made supersonic flight impossible in turbine-powered aircraft 10 years ago (see graph). The F-80, designed in 1944, had a wing thickness of 13%, aspect ratio of 6.3, and 4000 pounds available thrust. This simply prohibited supersonic flight.

Today's fighter has one-half the drag of the 1944 model and thrust is up 300%. It took the work of both aircraft and engine designers to close the gap between power requirements and power availability.

The central theme of the Lockheed engineer is reflected in his observation that "there is nothing good aerodynamically about low-aspect-ratio" wings, but they are required for the low thickness ratios "structurally impossible with greater wing spans." Choice then becomes a relative matter —which low-aspect-ratio wing configuration offers the best potential, the delta or the straight-wing form?

To highlight the need for thin wings on supersonic aircraft, Johnson shows that at Mach 1.5 a wing of three per cent thickness has only 63% of the drag of a comparable five per cent thickness wing. It is this demand for a very thin wing which tends to defeat some of the advantages claimed for delta wings—the availability of space in the thick wing for fuel and equipment.

Lockheed's experience with deltas, verified by the deltas built to date (see table), showed that fuselage sizes remained relatively the same as other types and that their low wing loading plus large vertical tail areas increased total drag.

Other specific charges made against the delta include: reversal of directional stability prior to wing stall; lift/drag ratios of trimmed aircraft (such as prevail during landing) of approximately half those of conventional aircraft; landing flare rates of descent requiring as much as 25″ shock strut travel, resulting in major weight increases; the airport "real estate" problem growing out of delta lift characteristics, and comparable problems.

Johnson does not find the straight-wing supersonic aircraft free of trouble. All low-aspect-ratio aircraft, he claims, have lateral-directional stability problems which will require artificial stability devices. Both lowaspect ratios and high-sweep wings will probably require yaw and roll dampers, flight characteristics at high angles of attack can prove troublesome, aero-elasticity and flutter will continue to plague low-aspect-ratio wings of any type, etc.

It remains for actual flight experience with delta-wing configurations to prove or disprove Johnson's claims. The rapidly accumulating British experience with both large and small deltas and the initial flight of Convair's delta-wing F-102 should accelerate that evaluation. • • •

COMPARISON OF SURFACE AREAS

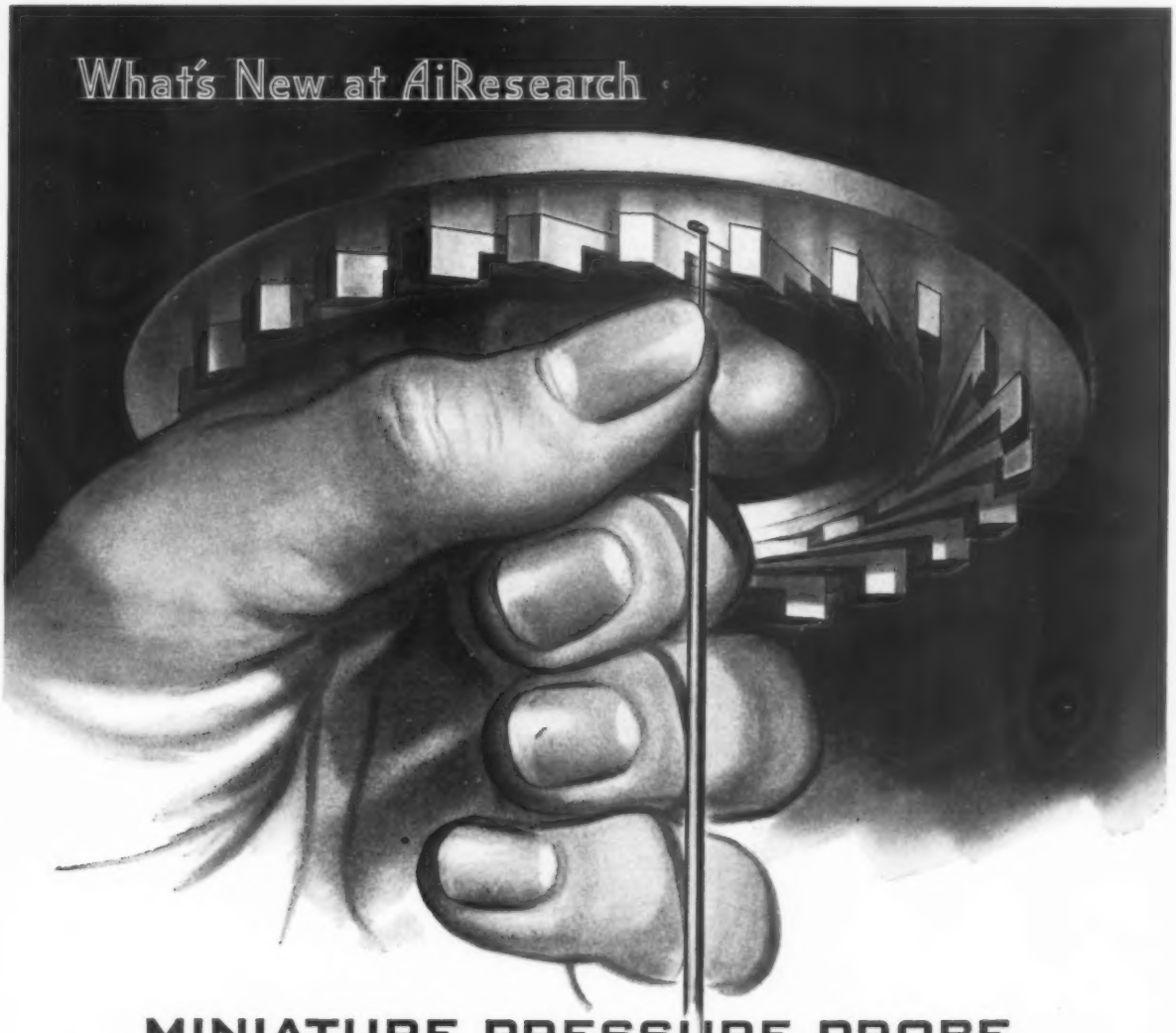
Various Airplane Configurations

TABLE I

AIRPLANE MODEL	OVERALL LENGTH FEET	WING AREA		HORIZONTAL TAIL AREA		VERTICAL TAIL AREA		TOTAL AREA OF WING AND EMPENNAGE	
		SQUARE FEET	% OF WING AREA	SQUARE FEET	% OF WING AREA	SQUARE FEET	% OF WING AREA	SQUARE FEET	% OF WING AREA
F-80A	34.5	237.6	100	43.5	18.3	22.5	9.5	303.6	127.8
F-86	37.54	287.9	100	33.9	11.8	33.4	11.6	355.3	123.4
XF-92	42.5	425	100	—	—	76.1	17.9	501.1	117.9
F-94C	40.08	232.8	100	60.3	25.9	28.0	12.02	321.1	138.0
F7U-3	43.17	535.3	100	—	—	147.4	27.5	682.7	127.5
AVRO 698	109	4230	100	—	—	294	6.9	4524.0	107.0
AVRO 707A	34.17	426.5	100	—	—	29.9	7.0	456.4	107.0
GLOSTER JAVELIN	57.0	905	100	79	8.7	61	6.7	1045.0	115.5
BOULTON-PAUL PX-120	29.63								
BOULTON-PAUL P-111	26.1	291.0	100	—	—	33.5	11.5	324.5	111.5

REFERENCE to current delta wing aircraft as "tailless" is a misnomer, Johnson claims, and presents this compilation of current fighter statistics to make his point. Large vertical tail areas of "tailless" deltas are major factor in total surface areas.

What's New at AiResearch



MINIATURE PRESSURE PROBE

developed by AiResearch lab to measure air flow through turbo-machinery

This tiny total pressure probe — part of a hypodermic needle and a section of 72 thousandths tubing — is a typical AiResearch requirement. It could not be purchased so it was created by an AiResearch laboratory technician.

Inserted into small, high speed turbo-machinery, it is designed to measure true total pressure within yaw variations up to 30° at velocities close to Mach 1.

By use of this total pressure probe, it is possible to make correction of air flow design to further improve the efficiency of small AiResearch air and gas turbines.

This is another example of how AiResearch laboratories must design and develop their own tools and equipment in order to create the unique, highly specialized AiResearch components so vital to every type of modern American aircraft.

Would you like to work with us? Qualified engineers, scientists and skilled craftsmen are needed here.

AiResearch Manufacturing Company

A DIVISION OF THE GARRETT CORPORATION

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WHO HAULS THE SHORT-HAU

U. S. DOMESTIC AIRLINES (CERTIFICATED)

PERCENTAGE DISTRIBUTION OF REVENUE PASSENGER MILES BY TRIP DISTANCE AND RELATIVE SHARES BY CARRIER GROUPS

15 LOCAL SERVICE (ESTIMATE)
4 SMALL TRUNK
7 MEDIUM TRUNK
BIG FOUR TRUNK

CUMULATIVE TOTALS
0— 500 MILES 45%
0—1000 " 61%
0—1500 " 79%

PERCENT OF INDUSTRY PASSENGER MILES

PASSENGER TRIP DISTANCE—MILES

SOURCE: ATA STUDY

AU ASSENGER?

Big Four carry 45% of traffic on under-100-mile flights.

By COLIN H. MCINTOSH

IN RECENT YEARS of booming business and upward spiralling airline traffic, the airline industry has begun to look good. Possibly, however, this is as good a time as any to ask if looks are deceiving. Have 15 years of regulation under the Civil Aeronautics Act produced a sound airline industry?

From a few simple charts highlighting some features of the domestic airline "look" there can be derived much food for thought—and questions. Our purpose is not to make sweeping conclusions or suggest easy panaceas, but merely to focus attention on some of the evidence.

The industry has been subdivided for study into five major groups of airlines similar to the groupings used by the CAB for subsidy separation. All local service carriers however, have been treated as a single group, thus reducing industry groups to four. The five basic groups are:

- GROUP I: **The Big Four**—American, Eastern, TWA, and United.
- GROUP II: **Medium Trunks**—Braniff, Capital, C & S, Delta, National, Northwest, and Western (including Inland).
- GROUP III: **Small Trunks**—Colonial, Continental, Mid-Continent (through August 16, 1952), Northeast.
- GROUP IV: **Local Service**—Mohawk, Piedmont, Pioneer, Southwest.
- GROUP V: **Local Service**—Allegheny, Bonanza, Frontier, Lake Central, Ozark, Southern, Trans-Texas, West Coast (including Empire), North

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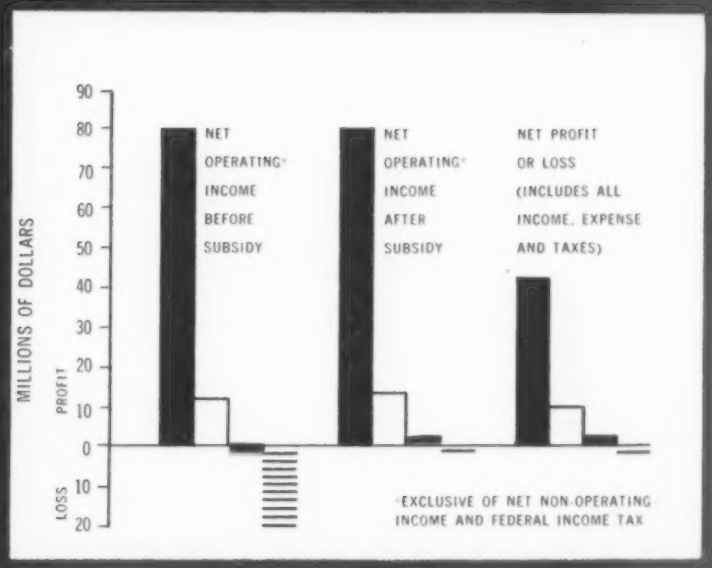
THE MAN behind this study, which AMERICAN AVIATION feels goes to the core of the dilemma facing the nation's scheduled airline industry, is Colin McIntosh, a former airline official and presently an industry consultant in Washington, D. C. He was aided in the statistical work involved in this study by Nicolas S. Detiere, formerly with the European Research Bureau and now with SABENA.

This is only the first part of what promises to be a very valuable analysis of some basic factors affecting current airline economic problems—The Editor.

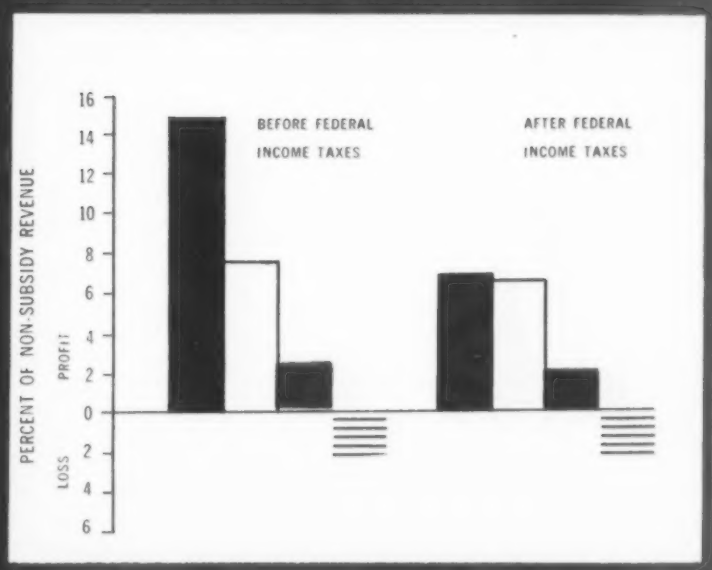
COMPARATIVE OPERATING RESULTS BY INDUSTRY GROUPS DOMESTIC AIRLINES 1952



SOURCE | CAB RECURRENT REPORTS

IS LOCAL SERVICE | 4 SMALL TRUNKS | 2 MEDIUM TRUNKS | BIG FOUR TRUNKS

RETURN AS PERCENTAGE OF NON-SUBSIDY REVENUES DOMESTIC AIRLINES 1952

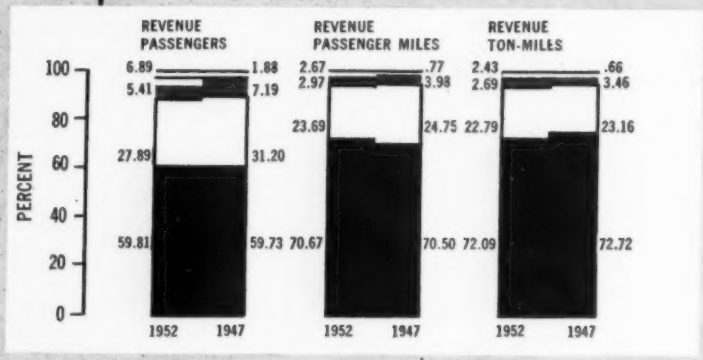


SOURCE | CAB RECURRENT REPORTS

IS LOCAL SERVICE | 4 SMALL TRUNKS | 2 MEDIUM TRUNKS | BIG FOUR TRUNKS

U. S. DOMESTIC AIRLINES

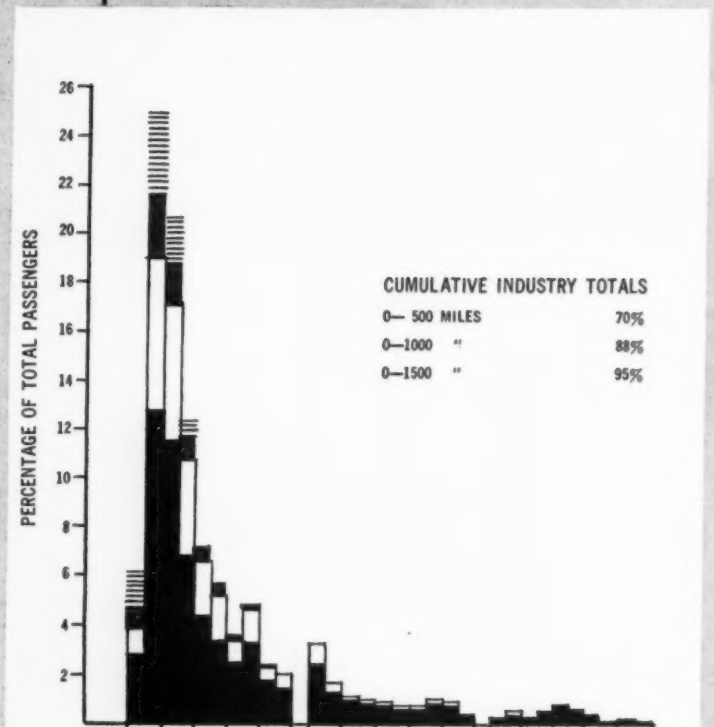
RELATIVE SHARES OF TRAFFIC BY CARRIER GROUPS 1952 AND 1947



SOURCE: CAB RECURRENT REPORTS

U. S. DOMESTIC AIRLINES (CERTIFICATED)

PERCENTAGE DISTRIBUTION OF REVENUE PASSENGERS BY TRIP DISTANCE AND RELATIVE SHARES BY CARRIER GROUPS



SOURCE: ATA STUDY 1951

15 LOCAL SERVICE (ESTIMATE) 4 SMALL TRUNKS 7 MEDIUM TRUNKS BIG FOUR

Central, Central, and Wiggins.

With record traffic during 1952, was the domestic airline business a profitable one? On a total industry basis, the answer is obviously yes. Yet an examination of industry profits distributed by carrier groups (see graph at top of preceding page) shows:

- **Net operating results** (prior to Federal income taxes) both before and after subsidy;
- **Net dollar profit or loss** (including all revenues, expenses and taxes).

The graph on the bottom of the preceding page translates dollar profits or losses into average rates of return for each group in terms of percentage of non-subsidy revenues both before and after taxes.

The purpose of the first graph is merely to illustrate *relative* distribution of industry profits (or losses) by carrier groups. It also raises an interesting question as to the adequacy of subsidy levels for the small trunks and local service airlines which are dependent upon them. The income tax "bite" on the profits of the "Big Four" is readily apparent.

The second graph serves to illustrate the *relative attractiveness* of the different segments of the industry based on a standard commonly used in general business. We recognize that the CAB has historically measured airline rate of return against *recognized* investment, the yardstick commonly applied by regulatory agencies to non-competitive public utilities; and, therefore, the rates of return charted here are not the equivalent of CAB findings.

The yardstick used here is used in recognition of two facts: (1) the airline business is highly competitive as well as being a regulated public utility, and (2) it seems difficult to obtain agreement on what constitutes investment.

The true significance of the rate of return graph, however, lies in the comparative rates of return for the carrier groups rather than the actual percentages shown. Against the returns shown for the larger and medium trunk airlines, do those of the smaller airlines (comprising more than one-half of the total) offer an attraction for investment?

This figure might also raise a question as to whether there is need to worry about "excessive" airline profits. It appears as if the Federal tax collector does a reasonably efficient job of equalizing profits.

We commonly hear the thesis that continued air traffic growth will prove to be the eventual answer to most economic problems of the industry. An

accompanying tenet appears to be that the weaker carriers of today will repeat with this growth the historic traffic development of the trunk industry.

In conjunction with this hope perhaps one facet of the problem which should be examined is the relative shares of total traffic enjoyed by the carrier groups and recent trends in this respect.

At the left, at top, is a graph which shows the relative shares of total traffic by carrier groups for the two calendar years 1947 and 1952. Over this period, of course, traffic for all carriers has increased and most of the locals have come into being.

The ability of the Big Four to maintain their relative share of total traffic is possibly more noteworthy than their historic disproportionate share. Likewise, it appears as if the increased share accruing to the locals by 1952 has been obtained at the expense of the trunk groups least able to lose ground. Is this a sound growth pattern towards a better balanced and more self-sufficient industry?

A concept commonly encountered is that the Big Four and other more profitable airlines are predominantly long haul carriers. Measured by the statistical concept of average passenger trip distance (total passenger-miles divided by total passengers) it is true that these airlines as a group enjoy relatively longer average hauls than others. However, from the evidence shown by the graphs on these pages, can any of the carriers be considered as long haul?

Two of the accompanying charts (at beginning of story and bottom of page 30) have been developed from CAB Origin and Destination Survey data (September, 1948, and March, 1949) analyzed by carriers by the Air Transport Association. Since the local service airlines were not included in this study, their contribution and distribution of traffic has been estimated from 1952 relationships. Inaccuracies resulting from this process are not deemed significant, due to the locals' small volume relative to the totals.

It is felt that these figures depict reasonably well the current distribution of the first class travel market, although there is evidence that the total market (first class and coach) has undergone some shifts since 1949. The figure on page 31 indicates that the average length of haul for the industry, the Big Four and medium trunks, has increased, while that of the small trunks and the locals has either decreased or remained the same.

It is reasonable to assume that the increased length of haul for the Big Four and medium trunks reflects in large degree the recent rapid growth of coach traffic, most of which is relatively long haul. Were a traffic distribution analysis available of 1952 origin and destination data it is probable that the graphs on this subject would be modified slightly.

It is not likely, however, that this shift would appreciably alter the relative shares of traffic carried by the several carrier groups in the mileage brackets. Moreover, the estimated degree of shift in traffic distribution from 1949 to 1952 is not felt to be great enough to invalidate the basic industry relationships shown by these figures.

As should be expected, most airline passengers travel comparatively short distances. Almost 25% of all travel is within the 100-199 mile bracket, and another 20-odd percent is in the 200-299 mile bracket. By comparison the percentages in the longer haul brackets (over 1000 miles) are remarkably low.

Perhaps more significant than the short haul aspect of air travel as a whole is the division of traffic in each mileage bracket among the carrier groups. Even in the shortest mileage bracket (less than 100 miles) the Big Four carry approximately 45% of all passengers. In all other brackets this group accounts for more than 50% of the total and virtually all traffic over 1200 miles.

The graph at the beginning of this story shows the percentage distribution of traffic volume in terms of passenger-miles. This provides a more realistic economic index than passenger count, since one person traveling 2000 miles has the equivalent revenue value of 20 persons traveling only 100 miles each.

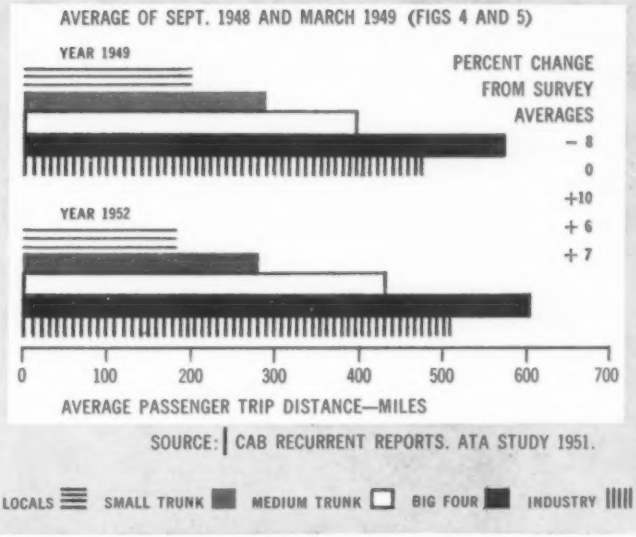
While this form of chart more correctly portrays the economic distribution of travel volume by giving proper weight to length of trip, it again only emphasizes the predominance of short distance travel and the preeminence of the Big Four in this market. Fifty percent of industry passenger-mile volume is accumulated over distances less than 750 miles and the Big Four realize 50% of their volume over distances less than 900 miles.

If the Big Four and medium trunk airlines are, as shown by these charts, carrying both the bulk of their own and total traffic in the short and medium mileage brackets, what, it may be asked, is the economic potential of the small airlines which by route structure are restricted to short haul traffic exclusively? An incidental question also arises as to the justification of the service restrictions imposed on the locals, whereby they are further restricted in competing with the trunks in their short haul field.

A comparison of the accompanying graphs indicates the economic value of the true long haul traffic to the few carriers enjoying it. Whereas the percentage of total passengers available for the long haul is small, the economic impact (passenger-mile volume) is large. The recent rapid growth of coach traffic, predominantly long haul, appears by 1952 to have expanded this market for the few carriers serving it more rapidly than the expansion of the short haul market (as evidenced by increases in average length of haul).

This has been done at reduced fare levels. What will be the effect on the industry economics if coach service at reduced fares is used to stimulate correspondingly the short haul market? If the Big Four can remain self-sufficient with a reduced fare level, what will be its effect on the remainder of the industry? • • •

AVERAGE PASSENGER TRIP DISTANCE TREND 1948 TO 1953



DIRECTING TECHNICAL DISCUSSIONS during Champion-sponsored meeting are Norman Parmet of TWA (standing); seated (left to right) are N. K. Davis, UAL; W. H. Wijnholds, KLM; R. W. Farren, TCA; J. M. Sorensen, NWA; and F. W. Lochner, EAL.

Growing Interest at Champion Meeting

Eight new airlines send representatives to ninth annual spark plug and ignition conference.

By Joseph S. Murphy

DESPITE the years of experience in the operation of piston engines in transport aircraft and the advances made in developing new ignition systems and improved spark plugs to better their operation, interest continues to run high in the search for still better performance. One of the better yardsticks of just how high this interest does run is the wealth of engineering and maintenance talent to be found on the attendance list of the Annual Spark Plug & Ignition Conference sponsored by the Champion Spark Plug Co.

This year's conference, the ninth of its kind, was no exception. On the contrary it was marked by the presence of eight new airlines among some 150 specialists from foreign and domestic airlines, the military services, oil companies, and engine and accessory manufacturers.

Discussions highlighting the three-day session were:

• **Success with new high altitude spark plugs.** A trend toward wider use by airlines and military services was evident.

• **Continued testing of Shell TCP** to combat lead fouling of spark plugs; although still not adopted by the airlines, signs point to its possible future use.

• **Wider acceptance of engine and ignition analyzers**—but opinions on their use as airborne trouble-shooting aids remain mixed.

• **Perennial plug cleaning** and testing problem persists.

High Altitude Plugs: Both American and Eastern Airlines reported improved operation with the use of new high altitude plugs placed in service during the past year. Carriers commented that the plugs are really misnamed and actually are a desirable installation for operation at sea level or high altitude.

American uses the Champion R-115 and R-103 mixed in R2800 engines of its Douglas DC-6, DC-6B, and Convair 240 airplanes, with the colder R-103 plug used in the rear position of the front cylinder bank only. Eastern employs a similar combination of the Champion R-103 and AC-271 plugs in its Constellation and Martin 4-0-4 fleets and is planning their installation in R2000 engines in DC-4 aircraft.

Other airlines reporting a switch to high altitude plugs were Pan American in Alaska-operated DC-4's, National in the Turbo-Compound-powered DC-7's which it has on order. The Air Force is adopting the plugs as part of a long-range replacement program in preference to a costly retrofit campaign at this time.

TCP Testing: Still the center of much conference discussion is Shell Oil Company's TCP (tricresy phosphate) fuel lead deterrent. With almost all large-scale airline testing just about completed and military work on its use with special instrumentation in a Boeing C-97 to start soon, the adoption of TCP is hanging in the balance.

Biggest airline testing program to date has been American's. In more than 40,000 engine hours of evaluating TCP in its Douglas DC-6 coach fleet, AA's Paul Kovac and T. J. Harris reported, the frequency of premature spark plug removals was not reduced nor was the off-schedule engine or cylinder removal rate affected. In one phase of AA testing where ignition analyzer patterns were photographed during take-offs in routine schedule operation to study spark plug misfiring, engines fed with TCP fuel showed a definite reduction in the number of plugs cutting out.

American's representatives at the conference also said that test results showed tendencies on the part of TCP to keep the engine blower section wet and free of carbon and dye deposits normally found in R-2800 engines, and that TCP introduced anti-wear properties in the engine oil which might prolong the life of such parts as reduction gears and cams.

In other testing of TCP, KLM Royal Dutch Airlines saw no benefit from TCP in reducing premature spark plug removals, Scandinavian Airlines System reported a 50% cut in the spark plug removal rate and a 100% jump in cylinder removals, and Trans World Airlines showed a lower spark plug removal rate but an increase in cylinder changes in the order of 2½ times that experienced during standard fuel operation.

USAF experience with TCP, primarily that of high altitude operation with the Convair B-36, continues to show an 80% lower spark plug incident rate with better than one-quarter million

Conference Notes

Attendance reached a new high, pointing up the increasing importance attached to industry technical sessions by operators here and abroad. Eight new airlines present were Trans-Texas, Continental, Pioneer, Pacific Northern, North Central, National, Northeast and Frontier.

• **Capital Airlines** spark plug cleaning and test set-up, where one man turns out 450 overhauled plugs daily, is considered one of the best in the industry. Other airlines are following the Capital pattern.

• **American Airlines** is looking into use of an automatic recorder as a substitute for the airborne ignition analyzer. Unit could be turned on during take-off and whenever signs of engine malfunction appeared, then played back through an oscilloscope for ground troubleshooting.

1953 A

Prepared by the Champion Spark Plug Co. from data submitted by t

Engine Model	Aircraft Model	No. Aircraft	Airline	Type Spark Plug Adopted As Standard	Original Gap Setting	High or Low Tension Ign. System	Water Injection	Avg Gap. Erosion Per 100 Hours	Max. Gap Allowed Before Removal (Overhaul)	Avg. Hours Total Plug Life	Max. CAA Approved Hours Before Removal (Overhaul)	Scheduled Hours Between Removals (Overhaul)	Actual Hours Between Removals (Overhaul)	Unsched. Plug Removals Per 1000 Eng. Hours	Analyzer Used As Criteria For Plug Removal
R-1820	DC-3	4	PAL	R37S-1 RS19-2R	.013-.016	HIGH	NO	.002	....	850	300	300	270	1.5	NO
R-1820	DC-3	23	AMA	RS19-2RS	.015-.018	HIGH	NO	....	....	800/1000	....	200	180	....	NO
R-1820	DC-3	25	CAP	C-35S	.011-.014	HIGH	NO	.009	....	....	ON COND.	130	125	2.1	NO
R-1820	DC-3	8	CAI	R37S-1	.011-.014	HIGH	NO	.003	NO STD.	750	325	250	200	.01	YES
R-1820	DC-3	12		R37S-1	.013-.016	HIGH	NO	.003	....	541	ON COND.	300	280	....	NO
R-1820	DC-3	19	NCA	R37S-1	.013-.016	HIGH	NO	.001	....	600	250	250	225	2.0	NO
R-1820	DC-3	1	TAL	RC-34	.011-.014	HIGH	NO	....	NOT SPECIFIED	....	400	375	...	....	NO
R-1820	LODESTAR	11	NAL	R37S-1	.011-.014	HIGH	NO	.001	....	450	150	150	150	3.93	NO
R-1830	DC-3	40	AFA	R37S-1	.013-.016	HIGH	NO	.005	.030	600	....	250	230	....	NO
R-1830	DC-3	6	ANA	RS-19-2R RS19-2RS	.015-.018	HIGH	NO	....	....	800/1000	....	200	190	....	NO
R-1830	DC-3	10	CAL	R37S-1	.013-.016	HIGH	NO	.006	NOT BASIS	700	ON COND.	250	200	1.0	NO
R-1830	DC-3	12	FAL	R37S-1	.013-.016	HIGH	NO	.002	....	547	ON COND.	300	225	.58	NO
R-1830	DC-3	10	MTC	R37S-1	.013-.016	HIGH	NO	....	....	600	....	200	200	3.0	NO
R-1830	DC-3	11	NEA	R37S-1	.013-.016	HIGH	NO	.004	....	900	ON COND.	400	385	3.14	NO
R-1830	DC-3	8	NWA	R37S-1	.013-.016	HIGH	NO	....	....	....	600	400	313	1.0	NO
R-1830	DC-3	4	PNA	R37S-1	.011-.014	HIGH	NO	.005	....	750	450	450	350	1.5	NO
R-1830	DC-3	29	PIA	R37S-1	.013-.016	HIGH	NO	.0012	.024	1450	150	150	148	....	NO
R-1830	DC-3	15	PIA	R37S-1	.013-.016	HIGH	NO	004	NO LIMIT	900	300	300	300	2.1	NO
R-1830	DC-3/C-47	9	SWISSAIR	R37S-1	.013-.016	HIGH	NO	....	....	800	....	200	...	....	NO
R-1830	DC-3	24	TAA	R37S-1	.013-.016	HIGH	NO	.0035	....	584	200	200	118	12.1	NO
R-1830	DC-3	12	WCA	R37S-1	.011-.014	HIGH	NO	.005	.028-.030	1150	600	600	580-600	....	NO
R-1830	DC-3	14	SABENA	RB19R2	.013-.016	HIGH	NO	....	....	637	....	125	93	1.72	NO
R-1830	DC-3	9	WAL	R37S-1	.....	HIGH	NO	.002	.020	900	ON COND.	420	420	1.63	NO
R-1830	DC-3	48	UAL	R37S-1	.013-.016	HIGH	NO	.003	....	700 to 800	ON COND.	300	200	....	NO
R-1830	DC-3	4	AAI	R37S-1	.011-.014	HIGH	NO	.002	.030	900	450	300	274	1	NO
R-1830	DC-3	27	TCA	R37S-1	.013-.016	HIGH	NO	.0033	....	650	....	275	155	1.76	...
R-1830	DC-3	14	AAA	RB27R	.011-.014	HIGH	NO	.002	....	600	ON COND.	200	115	2	NO
R-1830	DC-3	24	BNF	R37S-1	.013-.016	HIGH	NO	.004	TIME BASIS	....	ON COND.	330	250	....	NO
R-1830	DC-3	15	CPA	R37S-1	.013-.016	HIGH	NO	.0014	....	1000	....	250	...	1.3	NO
R-1830	DC-3	4	PAL	R37S-1	.013-.016	HIGH	NO	.003	....	850	300	300	270	2.5	NO
R-1830	DC-3	4	PAL	R37S-1	.013-.016	HIGH	NO	.003	....	850	300	300	270	2.5	NO
R-1830	CANSO	2	CPA	R37S-1	.013-.016	HIGH	NO	.0014	....	1000	....	250	...	....	NO
R-1830	DC-3	12	QEA	RB19R-3	.012	HIGH	NO	....	....	....	250	250	250	9.406	NO
R-1830	SANDRINGHAM	4	QEA	R37S-1	.013-.016	HIGH	NO	....	....	1150	250	250	250	....	NO
R-2000	DC-4	8	ANA	RS-19-2R RS-19-2RS	.015-.018	HIGH	NO	....	....	800/1000	....	200	180	....	NO
R-2000	DC-4	24	CAP	R37S-1	.013-.016	HIGH	NO	.007	....	....	400	150	140	.41	NO
R-2000	DC-4	5	CAI	R37S-1	.011-.014	HIGH	NO	.003	NO STD.	750	400	250	200	.005	YES
R-2000	DC-4	11	EAL	R37S-1 AC 117	.013-.016	HIGH	NO	.0025	TIME ELEMENT ONLY	700 700	400	300-350	330	....	NO
R-2000	C-54	17	FTL	R37S-1	.013-.016	HIGH	NO	APPROX. 20%	.030	400	ON CONDITION	280	118.7	18	YES
R-2000	DC-4	26	AFA	R37S-1	.013-.016	HIGH	NO	.005	.030	600	....	300	250	3	NO
R-2000	DC-4	3	NAL	R37S-1	.011-.014	HIGH	NO	.001	....	450	400	150	150	....	NO
R-2000	DC-4	24	NWA	R37S-1	.013-.016	HIGH	NO	....	....	....	600	400	354	.16	NO
R-2000	DC-4	5	PNA	R37S-1	.011-.014	HIGH	NO	.005	.022	500	350	300	200	1.0	NO
R-2000	DC-4	21	PAA-LAD	R37S-1	.013-.016	HIGH	NO	.004	....	....	ON COND.	225	200	1.2	NO
R-2000	C-54	4	S&W	R37S-1	.013-.016	HIGH	NO	....	....	206	250	250	206	.88%	NO
R-2000	DC-4	3	SWISSAIR	R37S-1	.013-.016	HIGH	NO	....	....	800	....	200	...	....	NO
R-2000	DC-4	4	TAA	R37S-1	.013-.016	HIGH	NO	.0035	....	588	200	200	119	14.6	NO
R-2000	C-54	13	TWA	R37S-1	.011-.014	HIGH	NO	....	NO LIMIT	....	....	410	375	1.4	NO
R-2000	DC-4	5	TAL	R37S-1	.013-.016	HIGH	NO	.0025	....	600	400	320	240	2.0	NO
R-2000	C-54	16	PAD	R37S-1	.013-.016	HIGH	NO	.0026	....	1000	ON COND	500	400	2.0	NO
R-2000	DC-4	7	SABENA	RB19R2	.013-.016	HIGH	NO	....	....	406	....	250	131	3.4	NO
R-2000	DC-4	5	WAL	R37S-1	.....	HIGH	NO	.003	.020	900	ON COND.	420	420	.91	NO
		22	UAL	R37S-1	.013-.016	HIGH	NO	.0035	....	700 to 800	ON COND.	400	222	....	NO

3 AIRCRAFT SPARK PLUG DATA CHART

by the individual airlines for the 9th Spark Plug and Ignition Conference September 22, 23 and 24, 1953, Tole

Analyzer Used As Criteria For Plug Removal	Lead Content in CC/US Gal.	Fuel Octane Rating	Average Number Take-Offs Per 100 Hrs.	Engine Power During			Engine Speed During			Mixture Control Position			Min. F A Cruise	Maximum Allowable Head Temp. Climb °C	Minimum Climbing Air Speed M. P. H.	Allowable Head Temp. Cruise °C		Minimum Allowable Head Temp. Descent °C	Constant Carb. Air Temp.	Carburetor Air Temp. if not Constant °C		During Hold	
				Take-off	Climb	Cruise	Take-off	Climb	Cruise	Taxi	Climb	Descent				Max.	Min.			Max.	Min.	Min. Air Speed mph	Min. Engine Power
NO	4.6	91-96	164	1200	660	600	2500	2000	1900	AR	AR	AR	AL	204	120	205	...	...	NO	...	...	120	21"MI
NO	5.5	91-96	50	1200	850	600	2500	2000	1900	AR	AR	AL	...	218	120	205	...	100	...	25	20	130	480
NO	4.0	90	150	1100	650	600	2400	2000	1900	AR	AR	AL	...	230	120	204	93	...	21	38	...	120	300
YES	4.0	91	130	1100	600	550	2250	1900	1800	FR	.082	.076	.075	232	120	204	149	93	...	NORMALLY COLD		120	500
NO	3.95	91-98	107	1200	650	550	2500	2050	1900	AR	AR	AL	.072	232	120	219	...	...	32	...	...	120	400
NO	4.0	90	200	1200	625	550	2500	2000	1900	AR	AR	AR	...	205	120	205	100	100	NO	35	5	115	425
NO	3.0	100	30	1200	625	600	2500	2000	1900	AR	AR	AL	AL	180	120	205	...	...	...	...	...	120	...
NO	4.0	91-96	161	1200	650	550 MAX	2500	2000 to 2100	1900	AR	AR	AL	.067	...	130	...	...	...	NO	...	...	...	...
NO	4.5	100-130	44	1200	780	600	2700	2300	2100	AR	AR	AR	...	260	110	160	130	160	...	50	—25	110	400
NO	5.5	91-96	50	1200	850	550	2700	2050	2050	AR	AR	AL	...	232	120	232	...	...	...	...	...	130	480
NO	4.0	91-98	125	1200	640	550	....	2050	2050	AR	AR	...	...	232	105	232	150	150	21	...	...	120	400
NO	4.0	91	163	1050	700	550	2700	2150	2050	AL	AR	AL	.065	260	120	232	170	170	NO	38	—34	120	450
NO	3.6	91-96	25	1200	700	525	2700	2325	2050	AR	AR	AR	...	232	120	200	175	150	NO	...	...	120	475
NO	3.91	91	160	1200	645	575	2700	2050	2050	AR	AR	AL	...	260	120	232	99	93	NO	40	...	120	...
NO	4.0	90-100	182	1200	650	575	2700	2050	2050	AR	AR	AL	.065	260	120	232	...	...	25	...	...	120	300
NO	4.6	91	50	1200	750	550-600	2700	2100	2050	AR	AR	AR	...	232	120	232	120	150	NO	32	...	...	...
NO	4.5	100-130	97.4	1200	750	550	2700	2100	2050	AR	AR	AR	.065 to .070	232	120	200	...	...	NO	38	15	120	NONI
NO	4.0	91	205	1200	700	600	2700	2350	2050	AR	AR	AL	.074	260	120	232	190	180	NO	40	—10	130	600
NO	4.6	100-130	90	1200	640 to 700	600	2700	2050 to 2300	2050	AR	AR	AL	.065	230	112	200	180	170	NO	40	...	144	450
NO	5.4	91-96	60	1200	700	550	2700	2050	2050	AR	AR	AL	.067	260	127	232	180	185	NO	35	...	127	450
NO	....	91	300	1200	1000	550-600	2700	2300	2050	AR	AR	AR	...	260	130	260	135	135	COLD	COLD	COLD	120	400
NO	4.59	100-130	101.5	1200	675	600	2700	2050	2050	AR	AR	AR	...	260	125	230	180	160	NO	40	—15	130	...
NO	4.0	91	122	1200	665	550	2700	2050	2050	AL	AR	AR	AL	281	120	204	150	150	NO	38	NONE	120	400
NO	4.0	91-98	112	1200	670	520	2700	2050	2050	AR	AR	AL	...	246	130	281	121	121	NO	32	...	121	VAR
NO	3.95	91	76	1200	675	575	2700	2050	2050	AR	AR	AR	...	232	120	204	180	180	NO	37.8	15	120	550
...	4.0	91-98	86.5	1115	740	550	2700	2325	2050	AR	AR	AL	...	260	...	232	120	120	...	...	...	87	...
NO	4.01	91-98	220	48"HG	31.75"	30"HG	2700	2050	2050	AR	AR	AR	...	260	120	230	100	100	NO	...	...	120	...
NO	4.0	91-100	....	1200	750	600	2700	2150	2050	TO&C	TO&C	CRUISE	...	232	130	200	...	...	NO	38	...	NO	PROC
NO	4.6	91-98	115	1200	785	550	2700	2325	2050	AR	AR	AR	...	245	140	217	120	120	20	...	...	140	RPM
NO	4.6	91-96	164	1200	670	530	2700	2050	2000	AR	AR	AR	AL	232	120	218	180	...	NO	...	...	120	21"
NO	4.6	91-96	164	1200	670	530	2700	2050	2000	AR	AR	AR	AL	232	120	218	180	...	NO	...	...	120	21"
NO	4.6	91-98	128	1200	785	550	2700	2325	2050	AR	AR	AR	...	245	...	...	...	...	...	...	...	...	...
NO	4.6	91-96	66	1200	700	550	2700	2300	2050	AR	AR	AL	AL	260	121	232	160	150	NO	...	...	175	300
NO	4.6	91-96	36	1150	950	580	2700	2400	2050	AR	AR	AL	AL	260	132	232	160	150	NO	...	...	127	450
NO	5.5	100-130	32	1450	900	500-700	2700	2250	2050	AR	AR	AL	...	232	160	232	...	150	...	...	...	150	480
NO	4.0	100	100	1450	835	660	2200	2200	1900	AR	AR	AL	...	232	140	232	121	...	...	38	...	140	400
YES	4.15	100	60	1350	850	675	2700	2250	2050	AR	AR	AL	...	232	140	204	149	96	...	COLD	COLD	135	...
NO	4.0	100-130	25.5	1450	900	700	2700	2300	2050	AR	AR	AR	.06	232	130-135	232	* NONE	* NONE	NO	38	NONE	130	550
YES	4.0	100	30	MAX.	80%	56.5%	2700	2300	1900	...	AR	...	...	230	140	232	160	120	NO	...	...	140	...
NO	4.5	100-130	40	1450	900	675	2700	2500	2150	AR	AR	AL	.066	232	150	232	...	...	...	40	—25	140	42
NO	4.0	100-130	62	1450	900	720 MAX.	2700	2250	2050	AR	AR	AL	.057	185	140	185	...	NO MINIMUM	NO	MFG. SPECS		NO MIN.	NO MIN.
NO	4.0	100-130	48	1450	900	700	2700	2200	2100	AR	AR	AL	.065	260	140	232	...	...	25	...	...	145	500
NO	4.6	100	18	1450	900	600-700	2700	2300	2050	AL	AR	AR	...	232	155	232	150	150	NO	...	...	...	...
NO	4.6	100-130	23.5	1450	900	700	2700	2200	2000	AR	AR	ML	.070	200	155	190	...	...	...	40	...	140	...
NO	4.5	100-130	15	1450	900	650-700	2700	2200	2050	AR	AR	AR	...	232	140	200	180	150	NO	40	...	140	550
NO	4.6	100-130	63	1450	825 to 910	750 to 500	2700	2250 to 2550	1600 to 2300	AR	AR	AL	.065	230	144	200	180	170	NO	40	...	185	550
NO	5.4	100-130	35	1450	900	650	2700	2250	2050	AR	AR	AL	.065	260	150	232	180	185	NO	35	...	150	500
NO	4.0	100-130	50	1450	950	650	2700	2300	2000	AR	AR	AL	...	232	150	232	...	...	NO	38	...	CRUISE	
NO	3.0	100	10	1450	875	625	2700	2250	2000	AR	AR	AL	AL	232	155	190	150	150	...	40	15	140	450
NO	4.6	100-130	14	1450	900	650	2700	2200	2000	AR	AR	AL	.070	220	140	180	...	...	NO	38	...	140	...
NO	4.59	100-130	21	1450	920	675	2700	2550	2050	AR	AR	AR	...	260	148	180	130	160	NO	40	—15	145	...
NO	4.0	100	109	1350	810 to 890	660	2700	2300	2050	AL	AR	AR	AL	260	140	232	150	150	NO	38 LB 15 HB	NONE	140	500
NO	4.0	100-130	40.5	1350	820	655	2700	2250	2050	AR	AR	AR	...	217	150	217	120	120	NO	40 HB 15 LB	30 HB 10 LB	140	...
																			NO	37.8	15	150	60
																			O	38	...	NO	PRO

1953 AIRCRAFT SPARK PLUG DATA CHART

ata submitted by the individual airlines for the 9th Spark Plug and Ignition Conference Se

(Overhaul)	Actual Hours Between Removals (Overhaul)	Unsched. Plug Removals Per 1000 Eng. Hours	Analyzer Used As Criteria For Plug Removal	Lead Content in CC/US Gal.	Fuel Octane Rating	Average Number Take-Offs Per 100 Hrs.	Engine Power During			Engine Speed During			Mixture Control Position			Min. F A Cruise	Maximum Allowable Head Temp. Climb °C	Minimum Climbing Air
							Take-off	Climb	Cruise	Take-off	Climb	Cruise	Taxi	Climb	Descent			
00	270	1.5	NO	4.6	91-96	164	1200	660	600	2500	2000	1900	AR	AR	AR	AL	204	120
00	180	....	NO	5.5	91-96	50	1200	850	600	2500	2000	1900	AR	AR	AL	...	218	120
80	125	2.1	NO	4.0	90	150	1100	650	600	2400	2000	1900	AR	AR	AL	...	230	120
50	200	.01	YES	4.0	91	130	1100	600	550	2250	1900	1800	FR	.082	.076	.075	232	120
00	280	....	NO	3.95	91-98	107	1200	650	550	2500	2050	1900	AR	AR	AL	.072	232	120
50	225	2.0	NO	4.0	90	200	1200	625	550	2500	2000	1900	AR	AR	AR	...	205	120
75	...	....	NO	3.0	100	30	1200	625	600	2500	2000	1900	AR	AR	AL	AL	180	120
50	150	3.93	NO	4.0	91-96	161	1200	650	550 MAX	2500	2000 to 2100	1900	AR	AR	AL	.067	...	130
0	230	....	NO	4.5	100-130	44	1200	780	600	2700	2300	2100	AR	AR	AR	...	260	110
00	190	....	NO	5.5	91-96	50	1200	850	550	2700	2050	2050	AR	AR	AL	...	232	120
50	200	1.0	NO	4.0	91-98	125	1200	640	550	....	2050	2050	AR	AR	...	...	232	105
00	225	.58	NO	4.0	91	163	1050	700	550	2700	2150	2050	AL	AR	AL	.065	260	120
00	200	3.0	NO	3.6	91-96	25	1200	700	525	2700	2325	2050	AR	AR	AR	...	232	120
00	385	3.14	NO	3.91	91	160	1200	645	575	2700	2050	2050	AR	AR	AL	...	260	120
00	313	1.0	NO	4.0	90-100	182	1200	650	575	2700	2050	2050	AR	AR	AL	.065	260	120
50	350	1.5	NO	4.6	91	50	1200	750	550-600	2700	2100	2050	AR	AR	AR	...	232	120
50	148	....	NO	4.5	100-130	97.4	1200	750	550	2700	2100	2050	AR	AR	AR	.065 to .070	232	120
00	300	2.1	NO	4.0	91	205	1200	700 640 to	600	2700	2350 2050 to	2050	AR	AR	AL	.074	260	120
00	...	....	NO	4.6	100-130	90	1200	700	600	2700	2300	2050	AR	AR	AL	.065	230	112
00	118	12.1	NO	5.4	91-96	60	1200	700	550	2700	2050	2050	AR	AR	AL	.067	260	127
00	580-600	....	NO	....	91	300	1200	1000	550-600	2700	2300	2050	AR	AR	AR	...	260	130
25	93	1.72	NO	4.59	100-130	101.5	1200	675	600	2700	2050	2050	AR	AR	AR	...	260	125
30	420	1.63	NO	4.0	91	122	1200	665	550	2700	2050	2050	AL	AR	AR	AL	281	120
00	200	....	NO	4.0	91-98	112	1200	670	520	2700	2050	2050	AR	AR	AL	...	246	130
00	274	1	NO	3.95	91	76	1200	675	575	2700	2050	2050	AR	AR	AR	...	232	120
25	155	1.76	...	4.0	91-98	86.5	1115	740	550	2700	2325	2050	AR	AR	AL	...	260	...
00	115	2	NO	4.01	91-98	220	48"HG	31.75"	30"HG	2700	2050	2050	AR	AR	AR	...	260	120
00	250	....	NO	4.0	91-100	....	1200	750	600	2700	2150	2050	TO&C	TO&C	CRUISE	...	232	130
00	...	1.3	NO	4.6	91-98	115	1200	785	550	2700	2325	2050	AR	AR	AR	...	245	140
00	270	2.5	NO	4.6	91-96	164	1200	670	530	2700	2050	2000	AR	AR	AR	AL	232	120
00	270	2.5	NO	4.6	91-96	164	1200	670	530	2700	2050	2000	AR	AR	AR	AL	232	120
00	...	....	NO	4.6	91-98	128	1200	785	550	2700	2325	2050	AR	AR	AR	...	245	...
00	250	9.406	NO	4.6	91-96	66	1200	700	550	2700	2300	2050	AR	AR	AL	AL	260	121
00	250	....	NO	4.6	91-96	36	1150	950	580	2700	2400	2050	AR	AR	AL	AL	260	132
00	180	....	NO	5.5	100-130	32	1450	900	500-700	2700	2250	2050	AR	AR	AL	...	232	160
00	140	.41	NO	4.0	100	100	1450	835	660	2200	2200	1900	AR	AR	AL	...	232	140
00	200	.005	YES	4.15	100	60	1350	850	675	2700	2250	2050	AR	AR	AL	...	232	140
0-350	330	....	NO	4.0	100-130	25.5	1450	900	700	2700	2300	2050	AR	AR	AR	.06	232	130-135
00	118.7	18	YES	4.0	100	30	MAX.	80%	56.5%	2700	2300	1900	...	AR	...	...	230	140
00	250	3	NO	4.5	100-130	40	1450	900	675	2700	2500	2150	AR	AR	AL	.066	232	150
50	150	....	NO	4.0	100-130	62	1450	900	720 MAX.	2700	2250	2050	AR	AR	AL	.057	185	140
00	354	.16	NO	4.0	100-130	48	1450	900	700	2700	2200	2100	AR	AR	AL	.065	260	140
00	200	1.0	NO	4.6	100	18	1450	900	600-700	2700	2300	2050	AL	AR	AR	...	232	155
25	200	1.2	NO	4.6	100-130	23.5	1450	900	700	2700	2200	2000	AR	AR	ML	.070	200	155
50	200	.88%	NO	4.5	100-130	15	1450	900	650-700	2700	2200	2050	AR	AR	AR	...	232	140
00	...	....	NO	4.6	100-130	63	1450	825 to 910	750 to 500	2700	2250 to 2550	1600 to 2300	AR	AR	AL	.065	230	144
0	119	14.6	NO	5.4	100-130	35	1450	900	650	2700	2250	2050	AR	AR	AL	.065	260	150
0	375	1.4	NO	4.0	100-130	50	1450	950	650	2700	2300	2000	AR	AR	AL	...	232	150
0	240	2.0	NO	3.0	100	10	1450	875	625	2700	2250	2000	AR	AR	AL	AL	232	155
0	400	2.0	NO	4.6	100-130	14	1450	900	650	2700	2200	2000	AR	AR	AL	.070	220	140
0	131	3.4	NO	4.59	100-130	21	1450	920	675	2700	2550	2050	AR	AR	AR	...	260	148
0	420	.91	NO	4.6	100	109	1350	810 to 890	660	2700	2300	2050	AL	AR	AR	AL	260	140
0	222	....	NO	4.0	100-130	40.5	1350	820	655	2700	2250	2050	AR	AR	AR	...	217	150

September 22, 23 and 24, 1953, Toledo, Ohio

Minimum Climbing Air Speed M. P. H.	Allowable Head Temp. Cruise °C Max.	Allowable Head Temp. Cruise °C Min.	Minimum Allowable Head Temp. Descent °C	Constant Carb. Air Temp.	Carburetor Air Temp. if not Constant °C Max.	Carburetor Air Temp. if not Constant °C Min.	During Holding Procedure: Min. Air Speed mph	Min. Engine Power	Min. F/A	Min. Head Temp. °C	Prior to Installation Are New Plugs: Degreased	Electrically Tested	Gap Checked	Thread Anti-Seize Compound Used	Is DC-4 Compound Used?	Plugs Overhauled Per Man Hour
120	205	...	...	NO	...	...	120	21"MP	AL	...	YES	YES	YES	MICA	NO	NO
120	205	...	100	...	25	20	130	480	...	160	....	YES	YES	B.G.	NO	8-10
120	204	93	...	21	38	...	120	300	...	93	YES	YES	NO	LUBRICATE	NO	50
120	204	149	93	...	NORMALLY COLD		120	500	.075	121	....	....	....	NONE	NO	8
120	219	...	...	32	...	...	120	400	.072	...	NO	NO	NO	SINCLAIR MICA-AA	NO	..
120	205	100	100	NO	35	5	115	425	...	100	NO	YES	YES	B.G.	NO	12
120	205	...	...	...	...	...	120	...	...	...	YES	NO	....	GRAPHITE	NO	10
130	...	...	...	NO	...	...	...	...	.067	...	....	YES	YES	B.G.	NO	40
110	160	130	160	...	50	—25	110	400	AL	150	NO	YES	YES	ESSO COMPOUND # 1	NO	...
120	232	...	...	...	...	...	130	480	...	165	....	YES	YES	B.G.	NO	8-10
105	232	150	150	21	...	...	120	400	.065	150	YES	YES	SPOT	NONE	NO	10-12
120	232	170	170	NO	38	—34	120	450	.065	170	NO	NO	NO	LUBRIPLATE 130-AA	YES	9
120	200	175	150	NO	...	...	120	475	...	150	NO	NO	NO	Champion	YES	50
120	232	99	93	NO	40	...	120	...	...	99	YES	YES	SPOT	LUBRIPLATE 130-A	NO	20
120	232	...	...	25	...	...	120	300	AL	...	YES	NO	NO	NONE	NO	..
120	232	120	150	NO	32	...	...	...	...	150	....	....	....	B.G. MICA-LUBE	NO	..
120	200	...	...	NO	38	15	120	NONE	AR	NONE	NO	YES	YES	LUBRIPLATE 113-AA	YES	10.7
120	232	190	180	NO	40	—10	130	600	.070	180	....	....	YES	.....	....	20
112	200	180	170	NO	40	...	144	450	.062	170	NO	YES	NO	ESSO AVIATION NO. 7	NO	20
127	232	180	185	NO	35	...	127	450	...	180 to 200	NO	YES	NO	GRAPHITE GREASE	NO	..
130	260	135	135	COLD	COLD	COLD	120	400	...	135	NO	NO	NO	LUBRIPLATE 630-AA	NO	..
125	230	180	160	NO	40	—15	130	...	AR	180	NO	YES	YES	GRAPHITE GREASE	NO	..
120	204	150	150	NO	38	NONE	120	400	AL	150	YES	NO	NO	LUBRIPLATE	NO	..
130	281	121	121	NO	32	...	121	VAR	...	121	YES	YES	YES	LUBRIPLATE 130 AA	NO	33
120	204	180	180	NO	37.8	15	120	550	...	200	NO	NO	NO	DAG	NO	10.12
..	232	120	120	...	...	...	87	...	...	120	NO	YES	NO	OIL DAG	NO	..
120	230	100	100	NO	...	...	120	...	...	...	NO	YES	YES	MIL C-5544	NO	10
130	200	...	...	NO	38	...	NO PROCEDURE				NO	NO	NO	MICALUBE	NO	22
140	217	120	120	20	...	...	140	RPM 2050	...	120	YES	YES	YES	NONE	NO	11
120	218	180	...	NO	...	...	120	21" MP	...	...	....	....	....	MICA	NO	18
120	218	180	...	NO	...	...	120	21" MP	...	...	YES	YES	YES	MICA	NO	18
...	...	...	...	...	...	...	...	...	...	...	YES	YES	YES	NONE	NO	11
121	232	160	150	NO	...	...	115	300	AL	160	YES	NO	YES	SHELL 7	NO	..
132	232	160	150	NO	...	...	127	450	AL	160	YES	YES	YES	SHELL 7	NO	..
160	232	...	150	...	...	...	150	480	...	170	....	YES	YES	B.G.	NO	8-10
140	232	121	...	...	38	...	140	400	...	120	NO	NO	NO	LUBRIPLATE	NO	50
140	204	149	96	...	COLD	COLD	135	...	...	149	YES	YES	YES	NONE	NO	8
130-135	232	* NONE	* NONE	NO	38	NONE	130	550	.0625	* AV.	NO	NO	NO	SINCLAIR MICA LUBE	NO	15
140	232	160	120	NO	...	...	140	...	...	120	....	....	....	BRAYOIL COMP. MIL-C-5544	....	..
150	232	...	...	...	40	—25	140	425	066	...	NO	YES	YES	ESSO COMPOUND # 1	NO	...
140	185	...	NO MINIMUM	NO	MFG. SPECS		NO MIN.	NO MIN.	.057	NO MIN.	...	YES	YES	B.G.	NO	40
140	232	...	...	25	...	...	145	500	AL	...	YES	NO	NO	NONE	NO	..
155	232	150	150	NO	...	...	...	...	...	150	....	....	....	DAG 41	NO	12
155	190	...	...	...	40	...	140	...	AL	...	NO	NO	NO	NONE	NO	20
140	200	180	150	NO	40	...	140	550	...	150	....	....	YES	DC4	YES	..
144	200	180	170	NO	40	...	185	550	.062	170	NO	YES	NO	ESSO AVIATION NO. 1	NO	20
150	232	180	185	NO	35	...	150	500	...	180 to 200	NO	YES	NO	GRAPHITE GREASE	NO	..
150	232	...	...	NO	38	...	CRUISE POWER				NO	NO	NO	NONE	NO	..
155	190	150	150	...	40	15	140	450	.064	130	YES	NO	....	GRAPHITE	YES	10
140	180	...	...	NO	38	...	140	...	AL	...	NO	YES	YES	MIL-C-5544	NO	25
148	180	130	160	NO	40	—15	145	...	AR	180	NO	YES	YES	GRAPHITE GREASE	YES	..
140	232	150	150	NO	38 LB 15 HB	NONE	140	500	AL	150	YES	NO	NO	LUBRIPLATE	NO	..
150	217	120	120	NO	40 HB 15 LB	30 HB 10 LB	140	...	...	120	YES	YES	YES	LUBRIPLATE 130 AA	NO	33
...	...	...	...	...	...	...	...	...	...	...	NO	NO	NO	DAG	NO	10-12

R-2000	DC-4	5	PNA	R37S-1	.011-.014	HIGH	NO	.005	.022	500	350	300	200
R-2000	DC-4	21	PAA-LAD	R37S-1	.013-.016	HIGH	NO	.004	....	....	ON COND.	225	200
R-2000	C-54	4	S&W	R37S-1	.013-.016	HIGH	NO	....	....	206	250	250	206
R-2000	DC-4	3	SWISSAIR	R37S-1	.013-.016	HIGH	NO	....	....	800	....	200	...
R-2000	DC-4	4	TAA	R37S-1	.013-.016	HIGH	NO	.0035	....	588	200	200	119
R-2000	C-54	13	TWA	R37S-1	.011-.014	HIGH	NO	....	NO LIMIT	....	....	410	375
R-2000	DC-4	5	TAL	R37S-1	.013-.016	HIGH	NO	.0025	....	600	400	320	240
R-2000	C-54	16	PAD	R37S-1	.013-.016	HIGH	NO	.0026	....	1000	ON COND	500	400
R-2000	DC-4	7	SABENA	RB19R2	.013-.016	HIGH	NO	....	....	406	....	250	131
R-2000	DC-4	5	WAL	R37S-1	.....	HIGH	NO	.003	.020	900	ON COND.	420	420
R-2000	C-54	23	UAL	R37S-1	.013-.016	HIGH	NO	.0035	....	700 to 800	ON COND.	400	222
R-2000	DC-4	2	AAI	R37S-1	.011-.014	HIGH	NO	.003	.030	900	450	400	352
R-2000	DC-4	7	BNF	R37S-1	.013-.016	HIGH	NO	.005	TIME BASIS	....	400	220	180
R-2000	DC-4	4	CPA	R37S-1	.013-.016	HIGH	NO	.0014	....	1000	....	250	...
R-2000	DC-4	5	QEA	R37S-1	.013-.016	HIGH	NO	....	....	900	300	300	300
R-2800	C-46	26	FTL	R37S-1	.013-.016	HIGH	NO	App. 20%	.030	400	ON COND.	280	91.5
R-2800	C-46	2	NAL	R37S-1	.011-.014	HIGH	NO	.002	....	300	300	150	150
R-2800	C-46	40	SLICK	R37S-1	.013-.016	HIGH	NO	....	TIME ONLY	750	ON COND.	270	250
R-2800	C-46	4	TAL	R37S-1	.011-.014	HIGH	NO	.0025	....	600	400	320	100
R-2800	C-46	3	AAI	R37S-1	.011-.014	HIGH	NO	.002	.030	1000	450	330	289
R-2800	MARTIN 404	60	EAL	R103 AC 271	.013-.016	LOW	YES	.0025	TIME ONLY	425 750	500	400 to 450	425
R-2800	MARTIN 202A-404	52	TWA	R37S-1	.011-.014	LOW	YES	....	....	....	....	215	202
R-2800	MARTIN 202	9	PAL	R56S	.013-.016	HIGH	YES	.004	....	750	300	200	170
R-2800	CV-240	78	AAL	R-115 R-103	.013-.016	LOW	YES	.0024	.025	600	ON COND.	320	200
R-2800	CV-240	4	NEA	R37S-1	.013-.016	LOW	YES	.004	....	500	ON COND.	220	200
R-2800	CV-240	11	PAA-LAD	R37S-1	.013-.016	LOW	YES	.0015	....	....	ON COND.	230	220
R-2800	CV-240	11	KLM	R-37S-1 RB27	.015-.018	HIGH	YES	....	....	200 400	....	200 270	190 190
R-2800	CV-240	4	SWISSAIR	R37S-1	.013-.016	LOW	YES	....	....	200	....	200	....
R-2800	BR-763	12	AFA	R37S-1	.013.-016	LOW	YES	.003	....	600	....	300	....
R-2800	CV-240	5	TAA	R37S-1	.013-.016	HIGH	YES	.0025	....	300	200	200	115
R-2800	CV-240	6	SABENA	R37S-1	.013-.016	LOW	YES	....	....	793	....	300	255
R-2800	CV-240	10	WAL	R37S-1	.....	LOW	YES	.006	.020	420	ON COND.	420	200
R-2800	CV-340	7	CAL	R37S-1 R33S	.013-.016	LOW	YES	.001	NOT BASIS	700	ON COND.	250	220
R-2800	CV-340	2	PIA	R56S	.015-.018	HIGH	YES	....	.024	....	400	400	....
R-2800	CV-340	40	UAL	R37S-1 R-56S	.013-.016	LOW	YES	.002	.025	1000 to 1200	ON CONDI-TION	400 300	213
R-2800	CV-340	23	BNF	R-56S	.013-.016	LOW	YES	.004	TIME BASIS	....	ON COND.	220	150
R-2800	CV-240	5	CPA	R37S-1 R33S	.013-.016	LOW	YES	.0014	....	1000	....	250	....
R-2800	DC-6	49	AAL	R-115 R-103	.013-.016	LOW	NO	.0017	.025	600	ON COND.	400	290
R-2800	DC-6B	29	AAL	R-115 R-103	.013-.016	LOW	YES	.0021	.025	600	ON COND.	400	340
CB16 R-2800	DC-6	6	KLM	R-37S-1 RB-19	.015-.018	LOW	YES	....	....	370 370	....	370 185	370 185
CB17 R-2800	DC-6B	7	KLM	R-37S-1 RB-19	.015-.018	LOW	YES	....	....	370 370	....	370 185	370 185
CB16 R-2800	DC-6 DC-6B	14	NAL	R37S-1	.011-.014	LOW	YES	.002	....	300	ON COND.	150	150
CB16 R-2800	DC-6	6	PANAGRA	R37S-1	.013-.016	LOW	YES	.003[1] .0015[2]	....	NEW ONLY	ON COND.	150 [1] 300 [2]	125 [1] 250 [2]
CB16 R-2800	DC-6B	2	PANAGRA	R37S-1	.013-.016	LOW	YES	.003[1] .0015[2]	....	NEW ONLY	ON COND.	150 [1] 300 [2]	125 [1] 250 [2]
CB17 R-2800	DC-6B	18	PAA-AD-LAD	R37S-1	.013-.016	LOW	YES	.002	....	....	ON COND.	300	285
R-2800	DC-6	3	PIA	R37S-1	.013-.016	HIGH	NO	.003	.024	600	200	200	198
R-2800	DC-6B	2	PIA	R56S	.013-.016	LOW	YES	.0015	.024	1200	400	400	390
CA15 R-2800	DC-6	5	SABENA	R37S-1	.013-.016	LOW	YES	....	....	486	....	300	137
CB17 R-2800	DC-6B	6	SABENA	R37S-1	.....	LOW	YES	....	....	....	....	300	....
CA15 R-2800	DC-6	12	SAS	R37S-1	.011-.014	HIGH	YES	....	....	ONE RUN 150	....	150+50	....
CB17 R-2800	DC-6B	8	SAS	R37S-1	.011-.014	LOW	YES	....	....	ONE RUN 300	....	300+40	....
CB17 R-2800	DC-6A	4	SLICK	R37S-1	.013-.016	LOW	YES	....	TIME ONLY	850	ON COND.	450	425
CB R-2800	DC-6B	3	SWISSAIR	R37S-1	.013-.016	LOW	YES	....	....	NEW ONLY	....	200	....
CA15 R-2800	DC-6	4	TAA	R37S-1	.013-.016	HIGH	YES	.0025	....	ONE RUN 180	200	200	....

200	1.2	NO	4.6	100-130	23.5	1450	900	700	2700	2200	2000	AR	AR	ML	.070	200	155	190	...
206	.88%	NO	4.5	100-130	15	1450	900	650-700	2700	2200	2050	AR	AR	AR	...	232	140	200	180
...	....	NO	4.6	100-130	63	1450	825 to 910	750 to 500	2700	2250 to 2550	1600 to 2300	AR	AR	AL	.065	230	144	200	180
119	14.6	NO	5.4	100-130	35	1450	900	650	2700	2250	2050	AR	AR	AL	.065	260	150	232	180
375	1.4	NO	4.0	100-130	50	1450	950	650	2700	2300	2000	AR	AR	AL	...	232	150	232	...
240	2.0	NO	3.0	100	10	1450	875	625	2700	2250	2000	AR	AR	AL	AL	232	155	190	150
400	2.0	NO	4.6	100-130	14	1450	900	650	2700	2200	2000	AR	AR	AL	.070	220	140	180	...
131	3.4	NO	4.59	100-130	21	1450	920	675	2700	2550	2050	AR	AR	AR	...	260	148	180	130
420	.91	NO	4.0	100	109	1350	810 to 890	660	2700	2300	2050	AL	AR	AR	AL	260	140	232	150
222	....	NO	4.0	100-130	40.5	1350	820	655	2700	2250	2050	AR	AR	AR	...	217	150	217	120
352	2	NO	4.0	100	25	1350	850	675	2700	2250	2000	AR	AR	AR	...	232	155	205	180
180	....	....	4.0	100	82	1450	835	650	2700	2300	2050	TO&C	TO&C	CRUISE	...	232	150	200	...
...	3.7	NO	4.6	100-130	78	1450	900	675	2700	2200	VARIES	AR	AR	AR	...	260	155	217	120
300	1.085	NO	4.6	100-130	14	1450	880	650	2700	2250	2050	AR	AR	AL	AL	260	148	232	180
91.9	19	YES	4.0	100	30	MAX.	1360	960	2700	2300	1900	...	AR	...	...	230	117	232	160
150	....	NO	4.0	100-130	....	2000	1200	900	2700	2200	1900 to 2000	AR	AR	AL	.067	200	135	200	... NO
250	....	NO	3.95 3.9	91-98 100-130	40	2000	1360	960	2700	2300	1900	AR	AR	AL	.068	232	130	190	140
100	10	NO	3	100	25	2000	1175	950	2700	2300	1900	AR	AR	AL	AL	232	145	200	150
289	1	NO	3.95 4.00	91-100	67	2000	1280	880	2700	2300	1800	AR	AR	AR	...	232	130	205	180
425	....	NO	4.0	100-130	134	2400	1350	1125	2800	2300	2100	AR	AR	AR	.053	260	140	232	NONE NO
202	1.2	....	4.0	100-130	99.6	2400	1375	1080	2800	2300	2100	AR	AR	AL	...	232	160	232	...
170	2.0	YES	4.6	100	218	2400	1325	1080	2800	2500	2200	AR	AR	AR	AL	232	150	200	190
200	3.87	YES	4.0	100-130	118	2400	1350	1100	2800	2300	2100	AR	AR	AR	.073	232	...	232	200
200	3.94	YES	3.9	100-130	125	2400	1350	1000	2800	2300	2000	AR	AR	CRUISE	...	260	180	232	120
220	3.0	NO	4.0	100-130	98	2400	1350	1200	2800	2400	2300	AR	AR	ML	.075	200	147	215	...
190	2.7	NO	4.6	100-130	60	2400	1400	1000	2800	2400	2100	AR	AR	AL	ML	200	160	200	...
190																			
....	....	NO	4.6	100-130	38	2400	1250 to 1350	1050 to 1100	2800	2300	1980 to 2300	AR	AR	ML	.062	230	162	190	180
....	....	YES	4.5	100-130	....	....	....	....	....	....	....	...	...	...	...	...	...	...	...
115	29.6	YES	5.4	100-130	50	2400	1350	1000	2800	2300	2000 LB 2100 HB	AR	AR	ML	.066	260	150	...	180
255	1.17	NO	4.59	100-130	71.2	2400	1360	950	2800	2400	2300	AR	AR	AR	...	260	160	230	180
200	.96	YES	4.0	100	77	2400	1400	1100	2800	2300	1900 to 2300	AR	AR	AR	12 BMEP DROP	260	160	32	150
220	2.1	YES	4.0	100-130	100	2400	1400	1100	2800	2400	2100	AR	AR	...	...	232	145	232	160
....	....	YES	4.5	100-130	39.8	2400	1400	1050	2800	2400	2300	AR	AR	AR	.065 to .070	232	155	200	NONE NO
213	2.7	NO	4.0	100-130	86.5	2400	1350	1000	2800	2300	2000	AL	AR	ML	.063	232	155	232	120
150	....	....	4.0	100	119	2400	1400	1100	2800	2400	2100	TO&C	MAN-UAL	MAN-UAL	7 BMEP DROP	232	160	200	180
....	1.5	YES	4.6	100-130	85	2400	1350	1040	2800	2300	VARIES	...	...	...	...	260	140	200	180
290	1.28	IN PART	4	100-130	40	2100	1350	1100	2800	2250	2200	AR	AR	AR	.073	232	...	232	200
340	.78	YES	4.0	100-130	43	2400	1400	1200	2800	2400	2300	AR	AR	AR	.073	232	...	232	200
370	2.8	NO	4.6	100-130	22	2400	1400	1050	2800	2400	2100	AR	AR	AR	ML	210	175	180	...
185																			
370	2.0	NO	3.0	108-135	22	2500	1500	1240	2800	2400	2200	AR	AR	AR	ML	210	175	200	...
185																			
150	1.06	YES	4.0	100-130	50	2400	1400	1150	2800	2300 2400	2000 2300	AR	AR	MAN-UAL	.080	200	170	200	... NON
125 [1] 250 [2]	1.0	NO	4.6	100-130	26	2400	1400	1200	2800	2300	2200	AR	MAN-UAL	MAN-UAL	1 BMEP DROP	200	184	200	190
125 [1] 250 [2]	1.0	NO	4.6	100-130	35	2400	1400	1150	2800	2300	2150	AR	MAN-UAL	MAN-UAL	7 BMEP DROP	200	184	200	190
285	2.5	YES	3.0	108-135	21	2500	1400 AV.	1125	2800	2400	2300	AR	AR	ML	.060-.067	232	155	200	...
98	1.46	YES	4.5	100-130	19.5	2100	1300	1000	2800	2300	2100	AR	AR	AR	.065				
90	1.03	YES	4.5	100-130	18.6	2400	1400 1500	1050	2800	2400	2300	AR	AR	AR	.070 .065	232 232	180 180	200 200	NONE NON NONE NON
37	4.8	NO	4.59	100-130	18.3	2400	1360	1000	2800	2400	2300	AR	AR	AR	.070 ...	260	180	230	180
..	....	....	4.59	100-130	....	2500	1500	1050	2800	2400	2200	AR	AR	AR	...	260	175	230	180
..	2.25	NO	4.6	100-130	40	2400	1200 1330	955 1000	2800	2400	1900 2900	AR	MAN-UAL	MAN-UAL	.064	185	173	185	175
.	1.21	NO	3.0	108-135	34	2500	1250 1450	1050 1150	2800	2400 2600	2050 2300	AR	MAN-UAL	MAN-UAL	.064	185	173	185	175
5	....	YES	3.9 3.02	100-130 108-135	33	2400	1500	1150	2800	2400	2150	AR	AR	AL	.070	260	160	200	180
.	....	NO	3.0 4.6	108-135 100-130	32	2500 2400	1400 1500	1240 800	2800	2400 2500	1600 2300	AR	AR	ML	.062	230	173	200	180
.	....	YES	5.4	100-130	14.5	2400	1350	950 1050	2800	2400	1900 2150	AR	AR	AR	.066	260	171	180	180

500	350	300	200	1.0	NO	4.0	100	15	1450	900	700	2700	2200	2000	AR	AR	ML	.070
...	ON COND.	225	200	1.2	NO	4.6	100-130	23.5	1450	900	700	2700	2200	2000	AR	AR	ML	.070
206	250	250	206	.88%	NO	4.5	100-130	15	1450	900	650-700	2700	2200	2050	AR	AR	AR	...
800	....	200	...	....	NO	4.6	100-130	63	1450	825 to 910	750 to 500	2700	2250 to 2550	1600 to 2300	AR	AR	AL	.065
588	200	200	119	14.6	NO	5.4	100-130	35	1450	900	650	2700	2250	2050	AR	AR	AL	.065
...	....	410	375	1.4	NO	4.0	100-130	50	1450	950	650	2700	2300	2000	AR	AR	AL	...
600	400	320	240	2.0	NO	3.0	100	10	1450	875	625	2700	2250	2000	AR	AR	AL	AL
1000	ON COND	500	400	2.0	NO	4.6	100-130	14	1450	900	650	2700	2200	2000	AR	AR	AL	.070
406	....	250	131	3.4	NO	4.59	100-130	21	1450	920	675	2700	2550	2050	AR	AR	AR	...
900	ON COND.	420	420	.91	NO	4.0	100	109	1350	810 to 890	660	2700	2300	2050	AL	AR	AR	AL
800	ON COND.	400	222	....	NO	4.0	100-130	40.5	1350	820	655	2700	2250	2050	AR	AR	AR	...
900	450	400	352	2	NO	4.0	100	25	1350	850	675	2700	2250	2000	AR	AR	AR	...
...	400	220	180	....	....	4.0	100	82	1450	835	650	2700	2300	2050	TO&C	TO&C	CRUISE	...
000	....	250	...	3.7	NO	4.6	100-130	78	1450	900	675	2700	2200	VARIES	AR	AR	AR	...
900	300	300	300	1.085	NO	4.6	100-130	14	1450	880	650	2700	2250	2050	AR	AR	AL	AL
400	ON COND.	280	91.9	19	YES	4.0	100	30	MAX.	1360	960	2700	2300	1900	...	AR	...	...
300	300	150	150	....	NO	4.0	100-130	....	2000	1200	900	2700	2200	1900 to 2000	AR	AR	AL	.067
750	ON COND.	270	250	....	NO	3.95 3.9	91-98 100-130	40	2000	1360	960	2700	2300	1900	AR	AR	AL	.068
600	400	320	100	10	NO	3	100	25	2000	1175	950	2700	2300	1900	AR	AR	AL	AL
000	450	300	289	1	NO	3.95 4.00	91-100	67	2000	1280	880	2700	2300	1800	AR	AR	AR	...
425 750	500	400 to 450	425	....	NO	4.0	100-130	134	2400	1350	1125	2800	2300	2100	AR	AR	AR	.053
...	....	215	202	1.2	....	4.0	100-130	99.6	2400	1375	1080	2800	2300	2100	AR	AR	AL	...
750	300	200	170	2.0	YES	4.6	100	218	2400	1325	1080	2800	2500	2200	AR	AR	AR	AL
600	ON COND.	320	200	3.87	YES	4.0	100-130	118	2400	1350	1100	2800	2300	2100	AR	AR	AR	.073
500	ON COND.	220	200	3.94	YES	3.9	100-130	125	2400	1350	1000	2800	2300	2000	AR	AR	CRUISE	...
...	ON COND.	230	220	3.0	NO	4.0	100-130	98	2400	1350	1200	2800	2400	2300	AR	AR	ML	.075
200	....	200	190	2.7	NO	4.6	100-130	60	2400	1400	1000	2800	2400	2100	AR	AR	AL	ML
300		200	190															
200	....	200	....	....	NO	4.6	100-130	38	2400	1250 to 1350	1050 to 1100	2800	2300	1980 to 2300	AR	AR	ML	.062
300	....	300	....	....	YES	4.5	100-130	....	....	....	....	....	....	....	...	...	...	...
300	200	200	115	29.6	YES	5.4	100-130	50	2400	1350	1000	2800	2300	2000 LB 2100 HB	AR	AR	ML	.066
793	....	300	255	1.17	NO	4.59	100-130	71.2	2400	1360	950	2800	2400	2300	AR	AR	AR	...
420	ON COND.	420	200	.96	YES	4.0	100	77	2400	1400	1100	2800	2300	1900 to 2300	AR	AR	AR	12 BMEP DROP
700	ON COND.	250	220	2.1	YES	4.0	100-130	100	2400	1400	1100	2800	2400	2100	AR	AR	...	...
...	400	400	....	....	YES	4.5	100-130	39.8	2400	1400	1050	2800	2400	2300	AR	AR	AR	.065 to .070
000 200	ON CONDITION	400 300	213	2.7	NO	4.0	100-130	86.5	2400	1350	1000	2800	2300	2000	AL	AR	ML	.063
...	ON COND.	220	150	....	....	4.0	100	119	2400	1400	1100	2800	2400	2100	TO&C	MAN-UAL	MAN-UAL	7 BMEP DROP
000	....	250	....	1.5	YES	4.6	100-130	85	2400	1350	1040	2800	2300	VARIES	...	...	...	...
600	ON COND.	400	290	1.28	IN PART	4	100-130	40	2100	1350	1100	2800	2250	2200	AR	AR	AR	.073
000	ON COND.	400	340	.78	YES	4.0	100-130	43	2400	1400	1200	2800	2400	2300	AR	AR	AR	.073
370 370	....	370 185	370 185	2.8	NO	4.6	100-130	22	2400	1400	1050	2800	2400	2100	AR	AR	AR	ML
370 370	....	370 185	370 185	2.0	NO	3.0	108-135	22	2500	1500	1240	2800	2400	2200	AR	AR	AR	ML
300	ON COND.	150	150	1.06	YES	4.0	100-130	50	2400	1400	1150	2800	2300 2400	2000 2300	AR	AR	MAN-UAL	.080
W LY	ON COND.	150 [1] 300 [2]	125 [1] 250 [2]	1.0	NO	4.6	100-130	26	2400	1400	1200	2800	2300	2200	AR	MAN-UAL	MAN-UAL	1 BMEP DROP
W LY	ON COND.	150 [1] 300 [2]	125 [1] 250 [2]	1.0	NO	4.6	100-130	35	2400	1400	1150	2800	2300	2150	AR	MAN-UAL	MAN-UAL	7 BMEP DROP
..	ON COND.	300	285	2.5	YES	3.0	108-135	21	2500	1400 AV.	1125	2800	2400	2300	AR	AR	ML	.060-.067
00	200	200	198	1.46	YES	4.5	100-130	19.5	2100	1300	1000	2800	2300	2100	AR	AR	AR	.065
00	400	400	390	1.03	YES	4.5	100-130	18.6	2400	1400 1500	1050	2800	2400	2300	AR	AR	AR	.070 .065 .070
36	....	300	137	4.8	NO	4.59	100-130	18.3	2400	1360	1000	2800	2400	2300	AR	AR	AR	...
..	....	300	....	....	....	4.59	100-130	....	2500	1500	1050	2800	2400	2200	AR	AR	AR	...
N	....	150-150	....	2.25	NO	4.6	100-130	40	2400	1200 1330	955 1000	2800	2400	1900 2900	AR	MAN-UAL	MAN-UAL	.064
	....	300-340	....	1.21	NO	3.0	108-135	34	2500	1250 1450	1050 1150	2800	2400 2600	2050 2300	AR	MAN-UAL	MAN-UAL	.064
	ON COND.	450	425	....	YES	3.9 3.02	100-130 108-135	33	2400	1500	1150	2800	2400	2150	AR	AR	AL	.070
		300	....	....	NO	3.0	108-135	32	2500	1400	1240							

0	200	155	190	...	...	...	40	...	140	...	AL	...	NO	NO	NO	NONE	NO	20
	232	140	200	180	150	NO	40	...	140	550	...	150	....	....	YES	DC4	YES	..
5	230	144	200	180	170	NO	40	...	185	550	.062	170	NO	YES	NO	ESSO AVIATION NO. 1	NO	20
5	260	150	232	180	185	NO	35	...	150	500	...	180 to 200	NO	YES	NO	GRAPHITE GREASE	NO	..
	232	150	232	...	...	NO	38	...	CRUISE POWER				NO	NO	NO	NONE	NO	..
	232	155	190	150	150	...	40	15	140	450	.064	130	YES	NO	....	GRAPHITE	YES	10
9	220	140	180	...	...	NO	38	...	140	...	AL	...	NO	YES	YES	MIL-C-5544	NO	25
	260	148	180	130	160	NO	40	—15	145	...	AR	180	NO	YES	YES	GRAPHITE GREASE	YES	..
	260	140	232	150	150	NO	38 LB 15 HB	NONE	140	500	AL	150	YES	NO	NO	LUBRIPLATE	NO	..
	217	150	217	120	120	NO	40 HB 15 LB	30 HB 10 LB	140	...	...	120	YES	YES	YES	LUBRIPLATE 130 AA	NO	33
	232	155	205	180	180	NO	37.8	15	150	600	...	200	NO	NO	NO	DAG	NO	10-12
	232	150	200	...	...	NO	38	...	NO PROCEDURE				....	....	....	MICALUBE	....	22
	260	155	217	120	...	25—5	...	...	130	400	...	...	YES	YES	YES	NONE	NO	11
	260	148	232	180	150	NO	32	...	146	420	AL	180	YES	....	YES	SHELL 7	NO	..
	230	117	232	160	120	NO	...	...	130	600	...	120	YES	YES	YES	BRAYOIL COMP. MIL-C-5544	NO	13.4
	200	135	200	...	NONE	NO	MFG. SPECS		...	...	.067	...	....	YES	YES	B. G.	NO	40
	232	130	190	140	140	NO	...	...	120	600	.077	140	NO	NO	NO	OIL DAG ON O. H. PLUGS	NO	21
	232	145	200	150	150	...	40	15	140	630	...	150	YES	NO	....	GRAPHITE	YES	10
	232	130	205	180	180	NO	37.8	15	140	600	...	190	NO	NO	NO	DAG	NO	10-12
	260	140	232	NONE	NONE	NO	38	NONE	130	AV. 750	.053	AV. 180	NO	NO	NO	SINCLAIR MICALUBE	NO	15
	232	160	232	...	...	NO	38	...	CRUISE POWER				NO	NO	NO	NONE	NO	..
	232	150	200	190	...	NO	...	...	140	21"	...	...	....	....	....	.....	YES	18
	232	...	232	200	150	NO	...	...	150	...	...	150	YES	NO	NO	MICA	NO	..
	260	180	232	120	120	NO 20 IN ICING	40	NONE	150	NONE	...	120	YES	YES	SPOT	LUBRIPLATE 130-A	NO	20
	200	147	215	...	...	...	40	...	140	...	AL	...	NO	NO	NO	NO	NO	..
	200	160	200	...	140	NO	38	...	150	800	...	130	YES	YES	YES	AEROSHELL COMP. NO. 8	IN HARNESS	18
	230	162	190	180	170	NO	40	...	184	630	.062	170	NO	YES	NO	ESSO AVIATION NO. 1	NO	20
	...	...	...	...	...	...	...	...	...	...	...	...	NO	YES	YES	ESSO COMPOUND # 1	NO	...
	260	150	...	180	185	NO	35	...	150	770	...	180	NO	YES	NO	GRAPHITE GREASE	NO	..
	260	160	230	180	160	NO	40	—15	145	...	AR	180	NO	YES	YES	GRAPHITE GREASE	NO	10-12
MEP P	260	160	32	150	150	NO	38 LB 15 HB	NONE	150	600	AL	150	YES	NO	NO	LUBRIPLATE	NO	..
	232	145	232	160	160	NO	P&W SPECS		150	975	.068	160	YES	YES	SPOT	NONE	NO	10-12
P	232	155	200	NONE	NONE	NO	38	15	150	800	AL	NONE	NO	YES	YES	LUBRIPLATE 113-AA	YES	10.7
	232	155	232	120	120	NO	38	...	144	...	...	120	YES	YES	YES	LUBRIPLATE 130-AA	NO	33
EP P	232	160	200	180	...	NO	38	...	NO PROCEDURE				....	....	....	MICALUBE	....	22
	260	140	200	180	...	...	38 LB 15 HB	...	140	850	...	150	YES	YES	YES	.....	NO	11
	232	...	232	200	150	NO	...	...	150	...	...	150	YES	NO	NO	MICA	NO	..
	232	...	232	200	150	NO	...	...	150	...	...	150	YES	NO	NO	MICA	NO	..
	210	175	180	...	170	NO	38	...	180	750	...	130	YES	YES	YES	AEROSHELL COMPOUND No. 8	IN HARNESS	18
	210	175	200	...	170	NO	38	...	180	750	...	130	YES	YES	YES	AEROSHELL COMP. No. 8	IN HARNESS	18
	200	170	200	...	NONE	NO	MFG. SPECS		NONE	NONE	.063	NONE	NO	YES	YES	B.G.	NO	40
EP	200	184	200	190	150	NO	30	—10	161	600	.063	150	NO	NO	NO	NONE	NO	..
EP 37	200	184	200	190	150	NO	30	—10	161	600	.063	150	NO	NO	NO	NONE	NO	..
	232	155	200	...	...	...	38	...	140	...	AL	...	NO	NO	NO	NO	NO	..
	232	180	200	NONE	NONE	NO	38	15	150	750	AL	NONE	NO	YES	YES	LUBRIPLATE 113-AA	YES	10-7
	232	180	200	NONE	NONE	NO	38	15	150	800	AL	NONE	NO	YES	YES	LUBRIPLATE 113-AA	YES	10-7
	260	180	230	180	160	NO	40	—15	145	...	AR	180	NO	YES	YES	GRAPHITE GREASE	NO	..
	260	175	230	180	...	NO	...	...	...	...	...	...	....	....	....	.....	....	..
	185	173	185	175	150	NO	40	—40	169	590	.064	150	NO	NO	YES	CHAMPION 119 INTAV-NO 1	YES	..
	185	173	185	175	150	NO	40	—40	164	720	.064	150	NO	NO	YES	CHAMPION 119 INTAV-NO 1	NO	..
	260	160	200	180	160	NO	...	...	160	750	.079	160	NO	NO	NO	OIL DAG ON O. H. PLUGS	NO	21
	[illegible]								213	800	.062	170	NO	YES	NO	ESSO AVIATION NO. 1	NO	20

CB17 R-2800	DC-6B	6	SABENA	R37S-1	.....	LOW	YES	....	....	....	....
CA15 R-2800	DC-6	12	SAS	R37S-1	.011-.014	HIGH	YES	....	....	ONE RUN 150	....
CB17 R-2800	DC-6B	8	SAS	R37S-1	.011-.014	LOW	YES	....	....	ONE RUN 300	....
CB17 R-2800	DC-6A	4	SLICK	R37S-1	.013-.016	LOW	YES	....	TIME ONLY	850	ON COND
CB R-2800	DC-6B	3	SWISSAIR	R37S-1	.013-.016	LOW	YES	....	....	NEW ONLY	....
CA15 R-2800	DC-6	4	TAA	R37S-1	.013-.016	HIGH	YES	.0025	....	ONE RUN 180	200
CB R-2800	DC-6A	1	TAL	R37S-1 R56S	.011-.014	LOW	YES	.0025	....	....	....
CA15 R-2800	DC-6	43	UAL	R37S-1 R56S	.013-.016	LOW	* 39-NO 4-YES	.002	.020	1000 1200	ON COND
CB16 R-2800	DC-6B	21	UAL	R37S-1 R56S	.013-.016	LOW	YES	.002	.020	1000 1200	ON COND
R-2800	DC-6B	4	WAL	R37S-1	.....	LOW	YES	.005	.020	420	ON COND
R-2800	DC-6	9	BNF	R37S-1	.013-.016	LOW	NO	.0025	TIME BASIS	....	650
R-2800	DC-6B	4	CPA	R37S-1 R33S	.013-.016	LOW	YES	.0014	....	1000	....
R-3350	L-049	5	CAP	R37S-1	.013-.016	HIGH	NO	.004	....	....	ON COND
R-3350	L-749	2	CAP	R37S-1	.013-.016	LOW	NO	.002	....	....	ON COND
C18BD1 R-3350	L-649	6	DC&S	R37S-1	.013-.016	LOW	NO	.0015	....	541	600
BD1 R-3350	L-749	20	EAL	R115 AC-271	.013-.016	LOW	NO	.002	TIME ELEMENT ONLY	1000	800
CB1 R-3350	L-1049	14	EAL	R103	.013-.016	LOW	NO	.0025	TIME ELEMENT ONLY	550	800
BD1 R-3350	L-749	15	KLM	R37S-1	.015-.018	LOW	NO	....	....	1800	....
R-3350	L-049	13	PAA-LAD	R37S-1	.013-.016	HIGH	NO	.004	....	....	ON COND
C18BA-3 R-3350	L-049	32	TWA	R37S-1	.011-.014	HIGH	NO	....	NO LIMIT	....	....
C18BD-1 R-3350	L-749 L-749A	36	TWA	R37S-1	.011-.014	LOW	NO	....	NO LIMIT	....	....
C18CB-1 R-3350	L-1049	10	TWA	R103	.011-.014	LOW	NO	....	NO LIMIT	....	....
C18BD-1 R-3350	L-749	5	BOAC	R37S-1	.....	LOW	NO	....	....	600	....
C18BD-1 R-3350 BD-1	L-749A	6	QEA	R37S-1	.013-.016	LOW	NO	....	....	600	600
R-3350	L-749	22	AFA	R37S-1	.013-.016	LOW	NO	.002	.025	1000	....
B-6 R-4360	B-377	10	NWA	R37S-1	.013-.016	LOW	YES	....	....	....	ON COND.
B-6 R-4360	B-377	15	PAD	R37S-1	.013-.016	LOW	YES	.0026	.032	1000	ON COND.
"	B-377	13	PAA-AD	R37S-1	.013-.016	LOW	YES	.0015	....	....	ON COND.
B-6 R-4360	B-377	6	UAL	R37S-1	.013-.016	LOW	YES	.0012	.030	1200 1500	ON COND.
HERC. 672	BRISTOL 170	3	ANA	LB1-1	.....	HIGH	NO	....	....	UPWARDS 2000	....
MERLIN 724	DC-4	23	TCA	LR3R	.019-.022	HIGH	NO	.0015	.030	ONE RUN	500

Estimated figures are bold.
1—Rear plugs, front cylinders
2—Remaining plugs of 1
3—Using only new plugs
*—Average 180° C
AV—Average
4—In groups of 14 for comparison with other engines
NOTE—In computing unscheduled plug removals, it was considered that any part of the set, up to one complete set, would constitute one removal.

....	150+50	....	2.25	NO	4.6	100-130	40	2400	1200 1330	955 1000	2800	2400	1900 2900	AR	MAN-UAL	MAN-UAL	.064
....	300+40	....	1.21	NO	3.0	108-135	34	2500	1250 1450	1050 1150	2800	2400 2600	2050 2300	AR	MAN-UAL	MAN-UAL	.064
COND.	450	425	....	YES	3.9 3.02	100-130 108-135	33	2400	1500	1150	2800	2400	2150	AR	AR	AL	.070
....	200	....	....	NO	3.0 4.6	108-135 100-130	32	2500 2400	1400 1500	1240 800	2800	2400 2500	1600 2300	AR	AR	ML	.062
200	200	....	....	YES	5.4	100-130	14.5	2400	1350	950 1050	2800	2400	1900 2150	AR	AR	AR	.066
...	ON COND.	....	2 to 3	YES	3.0-4.0	108-115	12	2400	1600	USO	2800	2400	2150	AR	AR	AL	.067
COND.	400 300	273	1.8	NO	4.0	100-130	DC6&B 42.6	2100	1350 1200	1100	2800	2250	2200	AL	MR	ML	.067
COND.	400 300	244	1.9	NO	4.0	100-130	....	2400	1400	1200	2800	2400	2300	AL	MR	ML	.063
COND.	420	200	.43	YES	4.0	100	36	2400	1400	1100	2800	2300	1900 2300	AR	AR	AR	12 BMEP DROP
650	440	350	....	....	4.0 to 4.6	100	52	2100	1300	1100	2800	2450	2100	TO&C	MAN-UAL	MAN-UAL	3 BMEP DROP
...	250	....	1.01	YES	3.0	108-135	16	2500	1500	1100 LB 1000 HB	2800	2400	VARIES	AR	AR	AR	...
COND.	300	275	5.5	YES	4.0	100	75	2200	1400	1100	2800	2300	2000	AR	AR	AL	...
COND.	300	275	3.3	YES	4.0	100	75	2400	1475	1200	2800	2300	2200	AR	AR	AL	...
600	600	580	....	NO	4.04	100-130	67	2500	1470	1300	2800	2300	2100	AR	ML	AL	...
300	500-600	550	....	NO	4.0	100-130	64.1	2500	1470	1400	2800	2300	2270	AR	AR	AR	.057
300	500-600	550	....	NO	4.6	115-145	41.4	2700	1600	1525	2900	2400	2400	AR	AR	AR	.061
..	750	695	3.0	NO	4.6	100-130	20	2500	1470	1200	2800	2400	2100	AR	AR	ML	ML
COND.	275	260	12.0	YES	4.6	100-130	21	2200	1400	1200	2800	2300	2000	AR	AR	ML	.060
...	215	202	2.4	NO	4.0	100-130	34.7	2200	1400	1100	2600	2300	2100	AR	AR	AL	...
..	410	397	2.3	NO	4.0 4.6	100-130	33.2	2500	1470	1200	2800	2300	AV 2050	AR	AR ML	AL	...
..	215	184	1.9	NO	4.6	115-145	24.3	2700	1600	1325	2900	2400	AV 2200	AR	AR	AL	...
..	300	259	3.0	NO	4.6	100-130	18	2500	1470	1200	2800	2400	2025	AR	AR	AL	...
00	600	600	1.760	NO	4.6	100-130	15	2500	1470	1200	2800	2400	2050	AR	AR	ML	.059
..	500	425	3	NO	4.5	100-130	20	2500	1450	1250	2800	2300	2200	AR	AR	AL	.060
OND.	550	457	.6	YES	2.9	108-135	43	3500	2400	1750	2700	2350	2150	AR	AR	ML	.063
OND.	700	550	12.5	YES	3.0	108-135	12	3500	2200	1750	2700	2200	2120	AR	ML AR	AL	.060
OND.	260	230	5.5	YES	3.0	108-135	11	3500	2400	1750	2700	2350	2120	AR	AR	AL	.060
OND.	620	238	2.8	NO	4.0	108-135	10.15	3500	2240	1675	2700	2350	2030	AR	AR	ML	.063
.	300	290	....	NO	5.5	100-130	50	1690	1550	850	2800	2400	1700	RICH	RICH	ECB	...
0	500	485	.5	YES	3.2 3.8	100-130	42	1700	1410	900	3000	2850	900	AUTO	AUTO	AUTO	...

AAA—Allegheny Airlines
AAI—Alaska Airlines, Inc.
AAL—American Airlines
AFA—Air France
ANA—Australian National Airways
BOAC—British Overseas Airways Corp.
BNF—Braniff Airways
CAI—Colonial Airlines
CAL—Continental Airlines
CAP—Capital Airlines
CPA—Canadian Pacific Airlines
DAL—Delta-C&S Air Lines
EAL—Eastern Air Lines
FAL—Frontier Air Lines

FTL—The Flying Tiger Line
KLM—K.L.M. Royal Dutch Ai
MTC—Maritime Central
NAL—National Airlines
NCA—North Central Airlines
NEA—Northeast Airlines
NWA—Northwest Airlines
PAA-AD—Pan American, Atla
PAA-LAD—Pan American, La
PAD—Pan American, Pacific A
PAL—Pioneer Air Lines
PANAGRA—Pan American-Gr
PIA—Philippine Airlines
PNA—Pacific Northern Airline

	YES	....	....	....	....	300	....	....	....	4.35	100-130	....	2500	1500	1200					
H	YES	....	....	ONE RUN 150	....	150+50	....	2.25	NO	4.6	100-130	40	2400	1200 1330	955 1000	2800	2400	1900 2900	AR	
	YES	....	....	ONE RUN 300	....	300+40	....	1.21	NO	3.0	108-135	34	2500	1250 1450	1050 1150	2800	2400 2600	2050 2300	AR	
	YES	....	TIME ONLY	850	ON COND.	450	425	....	YES	3.9 3.02	100-130 108-135	33	2400	1500	1150	2800	2400	2150	AR	
	YES	....	....	NEW ONLY	....	200	....	....	NO	3.0 4.6	108-135 100-130	32	2500 2400	1400 1500	1240 800	2800	2400 2500	1600 2300	AR	
H	YES	.0025	....	ONE RUN 180	200	200	....	....	YES	5.4	100-130	14.5	2400	1350	950 1050	2800	2400	1900 2150	AR	
	YES	.0025	....	....	....	ON COND.	....	2 to 3	YES	3.0- 4.0	108-115	12	2400	1600	USO	2800	2400	2150	AR	
	* 39-NO 4-YES	.002	.020	1000 1200	ON COND.	400 300	273	1.8	NO	4.0	100-130	DC6&B 42.6	2100	1350 1200	1100	2800	2250	2200	AL	
	YES	.002	.020	1000 1200	ON COND.	400 300	244	1.9	NO	4.0	100-130	....	2400	1400	1200	2800	2400	2300	AL	
	YES	.005	.020	420	ON COND.	420	200	.43	YES	4.0	100	36	2400	1400	1100	2800	2300	1900 2300	AR	
	NO	.0025	TIME BASIS	....	650	440	350	....	....	4.0 to 4.6	100	52	2100	1300	1100	2800	2450	2100	TO&C	
	YES	.0014	....	1000	....	250	....	1.01	YES	3.0	108-135	16	2500	1500	1100 LB 1000 HB	2800	2400	VARIES	AR	
H	NO	.004	....	....	ON COND.	300	275	5.5	YES	4.0	100	75	2200	1400	1100	2800	2300	2000	AR	
	NO	.002	....	....	ON COND.	300	275	3.3	YES	4.0	100	75	2400	1475	1200	2800	2300	2200	AR	
	NO	.0015	....	541	600	600	580	....	NO	4.04	100-130	67	2500	1470	1300	2800	2300	2100	AR	
	NO	.002	TIME ELE-MENT ONLY	1000	800	500-600	550	....	NO	4.0	100-130	64.1	2500	1470	1400	2800	2300	2270	AR	
	NO	.0025	TIME ELE-MENT ONLY	550	800	500-600	550	....	NO	4.6	115-145	41.4	2700	1600	1525	2900	2400	2400	AR	
W	NO	....	....	1800	....	750	695	3.0	NO	4.6	100-130	20	2500	1470	1200	2800	2400	2100	AR	
H	NO	.004	....	....	ON COND.	275	260	12.0	YES	4.6	100-130	21	2200	1400	1200	2800	2300	2000	AR	
H	NO	....	NO LIMIT	....	....	215	202	2.4	NO	4.0	100-130	34.7	2200	1400	1100	2600	2300	2100	AR	
	NO	....	NO LIMIT	....	....	410	397	2.3	NO	4.0 4.6	100-130	33.2	2500	1470	1200	2800	2300	AV 2050	AR	
	NO	....	NO LIMIT	....	....	215	184	1.9	NO	4.6	115-145	24.3	2700	1600	1325	2900	2400	AV 2200	AR	
	NO	....	....	600	....	300	259	3.0	NO	4.6	100-130	18	2500	1470	1200	2800	2400	2025	AR	
	NO	....	....	600	600	600	600	1.760	NO	4.6	100-130	15	2500	1470	1200	2800	2400	2050	AR	
	NO	.002	.025	1000	....	500	425	3	NO	4.5	100-130	20	2500	1450	1250	2800	2300	2200	AR	
	YES	....	....	....	ON COND.	550	457	.6	YES	2.9	108-135	43	3500	2400	1750	2700	2350	2150	AR	
	YES	.0026	.032	1000	ON COND.	700	550	12.5	YES	3.0	108-135	12	3500	2200	1750	2700	2200	2120	AR	
	YES	.0015	....	....	ON COND.	260	230	5.5	YES	3.0	108-135	11	3500	2400	1750	2700	2350	2120	AR	
V	YES	.0012	.030	1200 1500	ON COND.	620	238	2.8	NO	4.0	108-135	10.15	3500	2240	1675	2700	2350	2030	AR	
H	NO	....	....	UPWARDS 2000	....	300	290	....	NO	5.5	100-130	50	1690	1550	850	2800	2400	1700	RICH	
H	NO	.0015	.030	ONE RUN	500	500	485	.5	YES	3.2 3.8	100-130	42	1700	1410	900	3000	2850	900	AUTO	

gines
. it was considered that any part of the set, up
oval.

AAA—Allegheny Airlines
AAI—Alaska Airlines, Inc.
AAL—American Airlines
AFA—Air France
ANA—Australian National Airways
BOAC—British Overseas Airways Corp.
BNF—Braniff Airways
CAI—Colonial Airlines
CAL—Continental Airlines
CAP—Capital Airlines
CPA—Canadian Pacific Airlines
DAL—Delta-C&S Air Lines
EAL—Eastern Air Lines
FAL—Frontier Air Lines

FTL—The
KLM—K.L.
MTC—Mari
NAL—Nati
NCA—Nort
NEA—Nort
NWA—Nort
PAA-AD—
PAA-LAD—
PAD—Pan
PAL—Pion
PANAGRA
PIA—Philip
PNA—Pacif

	MAN-UAL	MAN-UAL	.064	185	173	185	175	150	NO	40	—40	169	590	.064	150	NO	NO	YES	CHAMPION 119 INTAV-NO 1	YES	..
	MAN-UAL	MAN-UAL	.064	185	173	185	175	150	NO	40	—40	164	720	.064	150	NO	NO	YES	CHAMPION 119 INTAV-NO 1	NO	..
	AR	AL	.070	260	160	200	180	160	NO	...	...	160	750	.079	160	NO	NO	NO	OIL DAG ON O. H. PLUGS	NO	21
	AR	ML	.062	230	173	200	180	170	NO	40	...	213	800	.062	170	NO	YES	NO	ESSO AVIA-TION NO. 1	NO	20
	AR	AR	.066	260	171	180	180	200	NO	35	...	159	770	...	180	NO	YES	NO	GRAPHITE GREASE	NO	..
	AR	AL	.067	200	175	200	180	180	...	40	...	160	950	...	180	YES	NO	....	GRAPHITE	YES	10
	MR	ML	.067	232	167	204	140	140	NO	30	...	161	VAR.	VAR.	140	YES	YES	YES	LUBRIPLATE 130-AA	NO	33
	MR	ML	.063	232	178	204	140	140	NO	30	...	161	VAR.	VAR.	140	YES	YES	YES	LUBRIPLATE 130-AA	NO	33
	AR	AR	12 BMEP DROP	260	170	232	150	150	NO	38 LB 15 HB	NONE	160	600	AL	150	YES	NO	NO	LUBRIPLATE	NO	..
&C	MAN-UAL	MAN-UAL	3 BMEP DROP	232	180	200	180	...	NO	38	...	NO PROCEDURE				....	....	....	MICA-LUBE	....	22
	AR	AR	...	260	184	200	180	150	...	38 LB 15 HB	...	150	980	...	150	YES	YES	YES	.....	NO	11
	AR	AL	...	...	...	232	...	...	...	38	...	150	400	...	...	NO	NO	NO	LUBRIPLATE	NO	50
	AR	AL	...	232	...	232	...	...	...	38	...	150	...	...	...	NO	NO	NO	LUBRIPLATE	NO	50
	ML	AL	...	200	175	180	...	...	...	25	...	160	600	...	...	NO	NO	NO	SINCLAIR MICA-AA	YES	..
	AR	AR	.057	232	155	232	NONE *	NONE *	NO	38	NONE	120	AV. 1000	.057	AV. 160	NO	NO	NO	SINCLAIR MICA-LUBE	NO	15
	AR	AR	.061	210	160	210	NONE *	NONE *	NO	38	NONE	130	AV. 900	.061	AV. 160	NO	NO	NO	SINCLAIR MICA-LUBE	NO	..
	AR	ML	ML	200	175	200	...	145	NO	...	...	185	800	...	130	YES	YES	YES	AEROSHELL COMPOUND NO. 8	IN HARNESS	18
	AR	ML	.060	232	180	232	...	...	...	40	...	140	...	AL	...	NO	NO	NO	NONE	NO	20
	AR	AL	...	232	180	232	...	...	NO	38	...	CRUISE POWER				NO	NO	NO	NONE	NO	..
	AR ML	AL	...	232	180	232	...	...	NO	38	...	CRUISE POWER				NO	NO	NO	NONE	NO	..
	AR	AL	...	232	180	232	...	...	NO	38	...	CRUISE POWER				NO	NO	NO	NONE	NO	..
	AR	AL	...	232	177	232	...	...	NO	...	...	...	...	...	...	NEW PLUGS HAVE NO GREASE	YES	YES	KEENOL (DUCKHAMS)	IN SOME LOCATIONS	..
	AR	ML	.059	232	173	232	160	150	NO	38	...	173	900	.06	160	YES	NO	YES	SHELL 7	NO	..
	AR	AL	.060	232	160-165	232	130	130	...	40	—25	140	600	.060	130	NO	YES	YES	ESSO COM-POUND # 1	NO	...
	AR ML	ML	.063	249	190	232	...	...	25	...	...	175	1000	.065	...	YES	NO	NO	NONE	NO	..
	AR	AL	.060	232	160	220	210	180	NO	38	...	160	1200	...	180	NO	YES	YES	MIL-C-5544	NO	25
	AR	AL	.060	232	175K	220	...	...	NO	38-54	...	140K	...	AL	...	NO	NO	NO	NONE	NO	..
	AR	ML	.063	232	202	220	...	140	25-30	38	10	161	VAR.	VAR.	140	YES	YES	YES	LUBRIPLATE 130-AA	NO	33
H	RICH	ECB	...	300	90	300	240	NOT STATED	...	...	...	140	...	...	200	.....	YES	YES	B. G.	NO	8-10
O	AUTO	AUTO	...	130 COOL-ANT	140	COOL-ANT	115	...	40-85	...	...	150	...	...	...	YES	YES	YES	GREDAG	NO	NOT DONE

-The Flying Tiger Line
—K.L.M. Royal Dutch Airlines
- Maritime Central
—National Airlines
—North Central Airlines
—Northeast Airlines
—Northwest Airlines
AD—Pan American, Atlantic
LAD—Pan American, Latin America
-Pan American, Pacific Alaska
-Pioneer Air Lines
AGRA—Pan American-Grace
-Philippine Airlines
-Pacific Northern Airlines

QEA—Qantas Empire Airways
SABENA—Sabena Belgian Airlines
SAS—Scandinavian Airline System
S&W—Seaboard & Western Airlines
SLICK—Slick Airways
SWISSAIR—Swiss Air Transport Co. Ltd.
TAA—Trans-Australia Airlines
TAL—Trans-Ocean Airlines
TCA—Trans-Canada Air Lines
TWA—Trans World Airlines
UAL—United Air Lines
WAL—Western Air Lines
WCA—West Coast Airlines

Estimated Sc

THE 107 top traffic-producing com
year will enplane 26,808,600 airlin
growth by 1970, when their total wi
estimates made recently by the Air
cities account for a very high percenta

In other compilations, ATA est
for the communities, and listed regis
general areas as of January 1, 1953.

The list shows that the 107 ar
had 39,807 registered planes, of which
sents 45.4% of the national total of reg

Revenue Passengers

(EXCLUDES HELICOPTER OPERATIONS)

THOUSANDS OF ENPLANING PASSENGERS

LOCATION	1953	1955	1960	1965	1970
Albany, N. Y.	116.8	138.0	141.8	138.0	154.7
Albuquerque, N. M.	116.8	117.3	145.8	150.2	168.4
Akron, O.	75.9	89.7	94.6	97.4	109.2
Amarillo, Tex.	67.2	72.5	78.8	81.2	91.0
Atlanta, Ga.	773.8	903.9	1004.7	1035.3	1137.5
Atlantic City, N. J.	26.2	31.1	23.6	16.2	13.7
Augusta, Ga.	43.8	48.3	47.3	48.7	54.6
Austin, Tex.	58.4	65.6	67.0	69.0	77.4
Baltimore, Md.	131.4	155.3	157.6	142.1	150.2
Billings, Mont.	38.0	41.4	39.4	40.6	45.5
Birmingham, Ala.	160.6	186.3	204.9	207.1	232.1
Boise, Ida.	46.7	51.8	55.2	56.8	59.2
Boston, Mass.	657.0	759.0	788.0	791.7	887.3
Bristol (Tri Cities), Tenn.	43.8	51.8	55.2	56.8	63.7
Buffalo, N. Y.	321.2	372.6	409.8	418.2	464.1
Catalina, Calif.	35.0	38.0	39.4	36.5	41.0
Charleston, S. C.	40.9	44.9	51.2	52.8	59.2
Charleston, W. Va.	116.8	134.6	153.7	158.3	177.5
Charlotte, N. C.	227.8	265.7	295.5	304.5	341.3
Chattanooga, Tenn.	52.6	58.7	59.1	60.9	68.3
Chicago, Ill.	2619.2	3105.0	3553.9	3670.2	4117.8
Cincinnati, O.	408.8	465.8	512.2	527.8	591.5
Cleveland, O.	589.8	700.4	807.7	832.3	932.8
Columbia, S. C.	58.4	69.0	74.9	73.1	81.9
Columbus, O.	154.8	179.4	197.0	194.9	209.3
Corpus Christi, Tex.	55.5	58.7	59.1	56.8	63.7
Dallas, Tex.	846.8	983.3	1083.5	1116.5	1251.3
Dayton, O.	166.4	200.1	228.5	223.3	227.5
Denver, Colo.	423.4	500.3	551.6	568.4	637.0
Des Moines, I.	81.8	89.7	86.7	89.3	100.1
Detroit, Mich.	686.2	828.0	985.0	1015.0	1137.5
El Paso, Tex.	146.0	165.6	157.6	142.1	159.3
Evansville, Ind.	75.9	89.7	110.3	113.7	132.0
Fort Wayne, Ind.	26.3	27.6	31.5	32.5	36.4
Fort Worth, Tex.	146.0	379.5	512.2	527.8	591.5

Aircraft De

(EXCLUDES HELICOP

THOUSA

LOCATION	19
Albany, N. Y.	1
Albuquerque, N. M.	1
Akron, O.	1
Amarillo, Tex.	
Atlanta, Ga.	4
Atlantic City, N. J.	
Augusta, Ga.	
Austin, Tex.	
Baltimore, Md.	2
Billings, Mont.	
Birmingham, Ala.	2
Boise, Ida.	
Boston, Mass.	3
Bristol (Tri Cities), Tenn.	
Buffalo, N. Y.	2
Catalina, Calif.	
Charleston, S. C.	
Charleston, W. Va.	1
Charlotte, N. C.	2
Chattanooga, Tenn.	1
Chicago, Ill.	11
Cincinnati, O.	2
Cleveland, O.	4
Columbia, S. C.	
Columbus, O.	1
Corpus Christi, Tex.	
Dallas, Tex.	5
Dayton, O.	2
Denver, Colo.	2
Des Moines, I.	
Detroit, Mich.	3
El Paso, Tex.	1
Evansville, Ind.	
Fort Wayne, Ind.	
Fort Worth, Tex.	

Scheduled Airline Service Through 1970 at 107 Airports

Also Registered Civil Aircraft by Counties

communities in the U.S., which this irline passengers, will show a 49.3% l will reach 40,042,400, according to Air Transport Association. The 107 centage of the national traffic total. A estimated yearly aircraft departures registered civil aircraft for the same

7 areas, which include 209 counties, which 23,543 were active. This repre- f registered aircraft and 44.3% of the active ones. In general, the areas having the largest number of airline passengers also have the most general aviation activity.

By 1955 enplaned passengers will total 31,535,400, or 17.6% over 1953, the study shows. The 1960 total of 35,200,200 will be 31.3% over 1953; 1965's 35,922,500 will be 34% ahead, and 1970's 40,042,400, up 49.3%.

The five leading cities in enplaned passengers are New York, Chicago, Washington, Los Angeles, and San Francisco, respectively. By 1970 New York's passengers will have increased 44.1%, Chicago's 57.2%, Washington's 54.5%, Los Angeles' 51%, and San Francisco's 49.7%.

• • •

Departures

ICOPTER OPERATIONS)

USANDS OF AIRCRAFT DEPARTURES

1953	1955	1960	1965	1970
14.2	16.8	17.5	17.3	20.0
11.6	11.7	15.3	15.8	17.7
13.2	15.5	16.4	16.9	19.0
8.7	9.7	11.3	12.0	14.0
45.8	53.8	60.2	62.4	68.3
3.5	4.3	3.2	2.0	1.7
8.0	8.9	8.8	9.1	10.2
8.5	9.6	10.7	11.0	12.4
20.2	24.6	26.3	23.7	25.0
5.4	6.1	6.3	6.8	7.6
22.5	26.2	34.1	34.5	38.7
5.8	6.7	7.6	8.1	8.5
38.6	46.0	49.3	51.0	59.2
9.3	11.1	12.3	12.6	14.2
26.6	31.1	34.6	35.6	39.8
2.2	2.3	2.4	2.3	2.5
7.0	7.7	8.8	9.1	10.2
16.9	19.8	22.9	23.6	26.5
22.0	26.2	31.1	32.9	37.9
10.3	11.6	11.8	12.2	13.7
119.6	142.1	167.2	174.8	196.0
29.2	33.9	38.7	40.6	47.3
45.4	54.3	65.1	69.4	79.4
9.7	11.5	13.0	12.7	14.2
17.6	20.6	23.9	24.4	27.0
7.8	8.3	8.6	8.4	9.4
51.0	59.6	67.7	70.9	79.4
21.5	26.7	32.6	31.9	32.5
26.5	31.4	34.8	36.0	40.3
9.9	10.9	11.2	11.9	13.3
30.5	38.5	50.5	54.9	63.2
11.4	13.0	12.9	11.8	13.6
8.6	10.3	13.4	14.2	16.6
6.6	7.1	8.3	8.5	9.6
29.2	47.4	51.2	52.8	59.2

Civil Aircraft Registere

In The County or Counties Comprising Metro

LOCATION		NUMBER OF REGISTERED AIRCRAFT			
				1/1/1953	
City	County	7/1/19-6	1/1/1949	Total	Active
Albany, N. Y.	Albany	60	89	100	48
Albuquerque, N. M.	Bernalillo	117	132	157	83
Akron, O.	Summit	204	233	204	128
	Stark	....	320	198	126
Amarillo, Tex.	Potter	67	120	110	88
Atlanta, Ga.	Fulton	211	349	266	126
	DeKalb	...	26	32	13
	Cobb	....	29	28	10
Altantic City, N. J.	Atlantic	42	38	48	29
Augusta, Ga.	Richmond	72*	61	54	19
Austin, Tex.	Travis	93	135	100	60
Baltimore, Md.	Anne Arundel	184	55	43	20
	Baltimore	...	276	308	177
Billings, Mont.	Yellowstone	78*	62	84	60
Birmingham, Ala.	Jefferson	97	204	134	88
Boise, Ida.	Ada	131	158	197	124
Boston, Mass.	Norfolk	119	109	85	61
	Suffolk	....	124	140	93
	Middlesex	...	198	259	169
	Essex	....	154	134	71
Bristol, Tenn.	Washington	29*	42	31	21
Buffalo, N. Y.	Erie	168	305	198	114
	Niagara	....	112	94	43
Charleston, S. C.	Charleston	81	77	94	47
Charleston, W. Va.	Kanawha	99*	118	86	31
Charlotte, N. C.	Mecklenburg	134	212	164	96
Chattanooga, Tenn.	Hamilton	95	97	66	40
Chicago, Ill.	Cook, Ill.	762	1321	1553	1055
	Dupage, Ill.	...	116	179	109
	Kane, Ill.	....	67	71	49
	Will, Ill.	...	89	74	44
	Lake, Ill.	...	148	178	85
	Lake, Ind.	...	165	191	119
Cincinnati, O.	Hamilton, O.	122	232	207	135

City
Mobile, Ala.
Moline, Ill.
Montgomery,
Muskegon, M
Nashville, Te
New Orleans,
New York, N
Norfolk, Va.
Oklahoma City
Omaha, Neb.
Orlando, Fla.
Pendleton, Or
Pensacola, Fl
Philadelphia,

Estimated Scheduled Airline Service Through 1970 at 107 A

Also Registered Civil Aircraft by Counties

07 top traffic-producing communities in the U.S., which this will enplane 26,808,600 airline passengers, will show a 49.3% by 1970, when their total will reach 40,042,400, according to made recently by the Air Transport Association. The 107 unt for a very high percentage of the national traffic total. other compilations, ATA estimated yearly aircraft departures ommunities, and listed registered civil aircraft for the same eas as of January 1, 1953.

e list shows that the 107 areas, which include 209 counties, 7 registered planes, of which 23,543 were active. This repre- % of the national total of registered aircraft and 44.3% of the active ones. In general, the areas having th passengers also have the most general aviati

By 1955 enplaned passengers will tot 1953, the study shows. The 1960 total of 3 1953; 1965's 35,922,500 will be 34% ah up 49.3%.

The five leading cities in enplaned Chicago, Washington, Los Angeles, and Sa 1970 New York's passengers will have increa Washington's 54.5%, Los Angeles' 51%, an

Aircraft Departures

(EXCLUDES HELICOPTER OPERATIONS)

TION	THOUSANDS OF AIRCRAFT DEPARTURES				
	1953	1955	1960	1965	1970
N. Y.	14.2	16.8	17.5	17.3	20.0
que, N. M.	11.6	11.7	15.3	15.8	17.7
	13.2	15.5	16.4	16 9	19.0
Tex.	8.7	9.7	11.3	12.0	14.0
Ga.	45.8	53.8	60.2	62.4	68.3
City, N. J.	3.5	4.3	3.2	2.0	1.7
Ga.	8.0	8.9	8.8	9.1	10.2
ex.	8.5	9.6	10.7	11.0	12.4
. Md.	20.2	24.6	26 3	23.7	25.0
Mont.	5.4	6.1	6.3	6.8	7.6
am, Ala.	22.5	26.2	34.1	34.5	38.7
a.	5.8	6.7	7.6	8.1	8.5
Mass.	38.6	46.0	49.3	51.0	59.2
Tri Cities), Tenn.	9.3	11.1	12.3	12.6	14.2
N. Y.	26.6	31.1	34.6	35.6	39.8
Calif.	2.2	2.3	2.4	2.3	2.5
n, S. C.	7.0	7.7	8.8	9.1	10.2
n, W. Va.	16.9	19.8	22.9	23.6	26.5
N. C.	22.0	26.2	31.1	32.9	37.9
oga, Tenn.	10.3	11.6	11 8	12.2	13.7
Ill.	119.6	142.1	167.2	174.8	196.0
i, O.	29.2	33.9	38.7	40.6	47.3
, O.	45.4	54.3	65.1	69.4	79.4
S. C.	9.7	11.5	13.0	12.7	14.2
O.	17.6	20.6	23.9	24.4	27.0
hristi, Tex.	7.8	8.3	8.6	8.4	9.4
ex.	51.0	59.6	67.7	70.9	79.4
O.	21.5	26.7	32.6	31.9	32.5
Colo.	26.5	31.4	34.8	36.0	40.3
es, I.	9.9	10.9	11.2	11.9	13.3
Mich.	30.5	38.5	50.5	54.9	63.2
Tex.	11.4	13.0	12.9	11.8	13.6
Ind.	8.6	10.2	12.4	14.2	15.6

LOCATION		NUMBER OF
City	County	7/1/19-6
Albany, N. Y.	Albany	60
Albuquerque, N. M.	Bernalillo	117
Akron, O.	Summit	204
	Stark	
Amarillo, Tex.	Potter	67
Atlanta, Ga.	Fulton	211
	DeKalb	
	Cobb	
Altantic City, N. J.	Atlantic	42
Augusta, Ga.	Richmond	72*
Austin, Tex.	Travis	93
Baltimore, Md.	Anne Arundel	184
	Baltimore	
Billings, Mont.	Yellowstone	78*
Birmingham, Ala.	Jefferson	97
Boise, Ida.	Ada	131
Boston, Mass.	Norfolk	119
	Suffolk	
	Middlesex	
	Essex	
Bristol, Tenn.	Washington	29*
Buffalo, N. Y.	Erie	168
	Niagara	
Charleston, S. C.	Charleston	81
Charleston, W. Va.	Kanawha	99*
Charlotte, N. C.	Mecklenburg	134
Chattanooga, Tenn.	Hamilton	95
Chicago, Ill.	Cook, Ill.	762
	Dupage, Ill.	
	Kane, Ill.	
	Will, Ill.	
	Lake, Ill.	
	Lake, Ind.	

Airports

g the largest number of airline
viation activity.

l total 31,535,400, or 17.6% over
of 35,200,200 will be 31.3% over
ahead, and 1970's 40,042,400,

ned passengers are New York,
l San Francisco, respectively. By
ncreased 44.1%, Chicago's 57.2%,
, and San Francisco's 49.7%.

• • •

Civil Aircraft Registered

In The County or Counties Comprising Metropolitan Areas

OF REGISTERED AIRCRAFT			
		1/1/1953	
19·6'	1/1/1949	Total	Active
60	89	100	48
117	132	157	83
204	233	204	128
...	320	198	126
67	120	110	88
211	349	266	126
..	26	32	13
...	29	28	10
42	38	48	29
72*	61	54	19
93	135	100	60
184	55	43	20
...	276	308	177
78*	62	84	60
97	204	134	88
131	158	197	124
119	109	85	61
...	124	140	93
...	198	259	169
	154	134	71
29*	42	31	21
168	305	198	114
...	112	94	43
81	77	94	47
99*	118	86	31
134	212	164	96
95	97	66	40
762	1321	1553	1055
..	116	179	109
...	67	71	49
...	89	74	44
..	148	178	85
	165	191	119

LOCATION		NUMBER OF REGISTERED AIRCRAFT			
				1/1/1953	
City	County	7/1/1946[1]	1/1/1949	Total	Active
Mobile, Ala.	Mobile	80*	73	63	29
	Baldwin	....	18	23	14
Moline, Ill.	Scott, Ia.	50*	65	52	44
	Rock Island Ill.	116*	80	69	52
Montgomery, Ala.	Montgomery	47*	77	73	46
Muskegon, Mich.	Muskegon	48	87	62	29
Nashville, Tenn.	Davidson	111	157	123	69
New Orleans, La.	Orleans	93	204	184	92
New York, N. Y.	Kings, N. Y.	1137	973	1095	806
	Queens, N. Y.	....	209	161	88
	Bronx, N. Y.	....	28	25	14
	Nassau, N. Y.	....	225	251	153
	Richmond, N. Y.	....	66	43	19
	Westchester, N. Y.	....	162	192	118
	Rockland, N. Y.	....	42	64	41
	Suffolk, N. Y.	....	216	250	134
	Hudson, N. J.	....	42	58	23
	Essex, N. J.	....	130	166	86
	Passaic, N. J.	....	65	88	56
	Bergen, N. J.	....	263	307	160
	Union, N. J.	....	78	142	54
	Monmouth, N. J.	....	102	102	54
	Morris, N. J.	....	104	104	60
	Middlesex, N. J.	....	96	79	46
	Somerset, N. J.	....	42	55	34
	Fairfield, Conn.	....	210	185	89
Norfolk, Va.	Norfolk	52	199	175	70
Oklahoma City, Okla.	Oklahoma	188	339	363	235
Omaha, Neb.	Douglas, Nebr.	122	212	181	131
	Pottawattamie, Ia.	....	41	38	29
Orlando, Fla.	Orange	142	200	133	76
Pendleton, Ore.	Umatilla	45*	82	90	54

Columbia, S. C.	58.4	69.0	74.9	73.1	[illegible]	
Columbus, O.	154.8	179.4	197.0	194.9	209.3	Columbus, O. 17.6
Corpus Christi, Tex.	55.5	58.7	59.1	56.8	63.7	Corpus Christi, Tex. 7.8
Dallas, Tex.	846.8	983.3	1083.5	1116.5	1251.3	Dallas, Tex. 51.0
Dayton, O.	166.4	200.1	228.5	223.3	227.5	Dayton, O. 21.5
Denver, Colo.	423.4	500.3	551.6	568.4	637.0	Denver, Colo. 26.5
Des Moines, I.	81.8	89.7	86.7	89.3	100.1	Des Moines, I. 9.9
Detroit, Mich.	686.2	828.0	985.0	1015.0	1137.5	Detroit, Mich. 30.5
El Paso, Tex.	146.0	165.6	157.6	142.1	159.3	El Paso, Tex. 11.4
Evansville, Ind.	75.9	89.7	110.3	113.7	132.0	Evansville, Ind. 8.6
Fort Wayne, Ind.	26.3	27.6	31.5	32.5	36.4	Fort Wayne, Ind. 6.6
Fort Worth, Tex.	146.0	379.5	512.2	527.8	591.5	Fort Worth, Tex. 29.2
Fresno, Calif.	38.0	44.9	47.3	48.7	54.6	Fresno, Calif. 5.8
Grand Rapids, Mich.	67.2	79.4	86.7	85.3	95.6	Grand Rapids, Mich. 9.2
Great Falls, Mont.	29.2	34.5	35.5	36.5	41.0	Great Falls, Mont. 5.0
Greensboro, N. C.	52.6	58.7	67.0	69.0	77.4	Greensboro, N. C. 12.5
Harrisburg, Pa.	38.0	44.9	51.2	52.8	59.2	Harrisburg, Pa. 7.6
Hartford, Conn.	111.0	127.7	137.9	142.1	159.3	Hartford, Conn. 12.9
Houston, Tex.	403.0	465.8	512.2	527.8	591.5	Houston, Tex. 24.3
Indianapolis, Ind.	233.6	279.5	327.0	341.0	382.2	Indianapolis, Ind. 28.8
Jackson, Miss.	58.4	65.6	70.9	73.1	81.9	Jackson, Miss. 10.7
Jacksonville, Fla.	224.8	265.7	295.5	304.5	341.3	Jacksonville, Fla. 27.4
Kansas City, Mo.	467.2	534.8	591.0	609.0	682.5	Kansas City, Mo. 36.5
Knoxville, Tenn.	111.0	127.7	137.9	142.1	159.3	Knoxville, Tenn. 13.5
Las Vegas, Nev.	87.6	96.6	98.5	101.5	113.8	Las Vegas, Nev. 8.2
Little Rock, Ark.	61.3	69.0	74.9	77.1	86.5	Little Rock, Ark. 10.8
Los Angeles, Calif.	1430.8	1673.3	1871.5	1928.5	2161.3	Los Angeles, Calif. 64.0
Louisville, Ky.	257.0	293.3	315.2	324.8	364.0	Louisville, Ky. 21.8
Lubbock, Texas.	35.0	41.4	47.3	48.7	54.6	Lubbock, Tex. 7.5
Madison, Wisc.	26.3	34.5	39.4	40.6	45.5	Madison, Wisc. 5.8
Medford, Ore.	35.0	38.0	35.5	36.5	41.0	Medford, Ore. 5.0
Memphis, Tenn.	251.1	293.3	331.0	341.0	377.7	Memphis, Tenn. 22.8
Miami, Fla.	671.6	759.0	827.4	852.6	955.5	Miami, Fla. 27.6
Midland, Tex.	58.4	65.6	70.9	73.1	81.9	Midland, Tex. 7.8
Milwaukee, Wisc.	189.8	227.7	267.9	276.1	309.4	Milwaukee, Wisc. 20.4
Minneapolis, Minn.	438.0	534.8	630.4	649.6	728.0	Minneapolis, Minn. 23.2
Mobile, Ala.	55.5	62.1	67.0	69.0	77.4	Mobile, Ala. 11.2
Moline, Ill.	32.1	34.5	39.4	40.6	45.5	Moline, Ill. 5.9
Montgomery, Ala.	26.3	34.5	39.4	40.6	45.5	Montgomery, Ala. 5.2
Muskeegon, Mich.	32.1	34.5	39.4	40.6	45.5	Muskeegon, Mich. 6.3
Nashville, Tenn.	175.2	200.1	216.7	223.3	250.3	Nashville, Tenn. 15.6
New Orleans, La.	385.4	448.5	496.4	507.5	568.8	New Orleans, La. 21.2
New York, N. Y.	3314.2	3898.5	4334.0	4364.5	4777.5	New York, N. Y. 137.0
Norfolk, Va.	184.0	213.9	236.4	243.6	273.0	Norfolk, Va. 9.7
Oklahoma City, Okla.	163.5	193.2	216.7	219.2	245.7	Oklahoma City, Okla. 18.2
Omaha, Neb.	140.2	162.2	177.3	182.7	200.2	Omaha, Neb. 12.7
Orlando, Fla.	43.8	51.8	59.1	60.9	68.3	Orlando, Fla. 9.2
Pendleton, Ore.	32.1	34.5	39.4	40.6	45.5	Pendleton, Ore. 5.6
Pensacola, Fla.	26.3	27.6	31.5	32.5	36.4	Pensacola, Fla. 6.2
Philadelphia, Pa.	350.4	396.8	394.0	365.4	409.5	Philadelphia, Pa. 35.4
Phoenix, Ariz.	189.8	220.8	244.3	251.7	282.1	Phoenix, Ariz. 14.6
Pittsburgh, Pa.	569.4	683.1	791.9	812.0	905.5	Pittsburgh, Pa. 47.5
Portland, Me.	29.2	31.1	31.5	28.4	31.9	Portland, Me. 4.0
Portland, Ore.	292.0	362.3	433.4	446.6	500.5	Portland, Ore. 22.5
Providence, R. I.	81.8	89.7	86.7	81.2	91.0	Providence, R. I. 9.7
Raleigh, N. C.	75.9	89.7	106.4	109.6	122.9	Raleigh, N. C. 11.0
Reno, Nev.	61.3	69.0	63.0	65.0	72.8	Reno, Nev. 5.5
Richmond, Va.	116.8	134.6	118.2	101.5	100.1	Richmond, Va. 16.7
Roanoke, Va.	49.6	55.2	59.1	60.9	68.3	Roanoke, Va. 9.9
Rochester, Minn.	35.0	48.3	63.0	65.0	72.8	Rochester, Minn. 6.3
Rochester, N. Y.	116.8	138.0	137.9	121.8	136.5	Rochester, N. Y. 16.7
Sacramento, Calif.	61.3	69.0	74.9	77.1	86.5	Sacramento, Calif. 9.3
Saginaw, Mich.	29.2	31.1	31.5	32.5	36.4	Saginaw, Mich. 4.2
St. Louis, Mo.	496.4	579.6	650.1	669.9	750.8	St. Louis, Mo. 36.2
Salt Lake City, Ut.	146.0	165.6	177.3	182.7	204.8	Salt Lake City, Ut. 11.8
San Antonio, Tex.	146.0	165.6	173.4	170.5	191.1	San Antonio, Tex. 12.3
San Diego, Calif.	192.7	220.8	240.3	243.6	268.5	San Diego, Calif. 11.5
San Francisco, Calif.	1124.2	1317.9	1477.5	1502.2	1683.5	San Francisco, Calif. 74.9
Savannah, Ga.	32.1	34.5	39.4	40.6	45.5	Savannah, Ga. 7.4
Scranton-Wilkes-Barre, Pa.	46.7	51.8	59.1	60.9	68.3	Scranton-Wilkes Barre, Pa. 9.4
Seattle, Wash.	423.4	507.2	591.0	629.3	705.3	Seattle, Wash. 17.5
Shreveport, La.	87.6	100.1	106.4	105.6	118.3	Shreveport, La. 15.4
South Bend, Ind.	29.2	31.1	35.5	36.5	41.0	South Bend, Ind. 7.3
Spokane, Wash.	93.4	103.5	110.3	113.7	127.4	Spokane, Wash. 8.1
Syracuse, N. Y.	143.1	165.6	181.2	182.7	204.8	Syracuse, N. Y. 15.1
Tampa, Fla.	175.2	210.5	248.2	255.8	286.7	Tampa, Fla. 20.6
Toledo, O.	55.5	69.0	78.8	81.2	91.0	Toledo, O. 10.3
Tucson, Ariz.	73.0	89.7	110.3	113.7	127.4	Tucson, Ariz. 7.3
Tulsa, Okla.	189.8	220.8	244.3	251.7	282.1	Tulsa, Okla. 20.2
Washington, D. C.	1471.7	1731.9	1970.0	2030.0	2275.0	Washington, D. C. 85.8
West Palm Beach, Fla.	40.9	44.9	51.2	52.8	59.2	West Palm Beach, Fla. 7.7
Wichita, Kan.	93.4	107.0	114.3	113.7	127.4	Wichita, Kan. 10.9
Worcester, Mass.	26.3	27.6	19.7	12.2	9.1	Worcester, Mass. 3.3
Youngstown, O.	40.9	51.8	59.1	60.9	68.3	Youngstown, O. 8.1
Total in millions	26.8	31.5	35.2	35.9	40.0	

17.6	20.6	23.9	24.4	27.0	Charleston, W. Va.	Kanawha	99*	118	86	31
7.8	8.3	8.6	8.4	9.4	Charlotte, N. C.	Mecklenburg	134	212	164	96
51.0	59.6	67.7	70.9	79.4	Chattanooga, Tenn.	Hamilton	95	97	66	40
21.5	26.7	32.6	31.9	32.5	Chicago, Ill.	Cook, Ill.	762	1321	1553	1055
26.5	31.4	34.8	36.0	40.3		Dupage, Ill.		116	179	109
9.9	10.9	11.2	11.9	13.3		Kane, Ill.		67	71	49
30.5	38.5	50.5	54.9	63.2		Will, Ill.		89	74	44
11.4	13.0	12.9	11.8	13.6		Lake, Ill.		148	178	85
8.6	10.3	13.4	14.2	16.6		Lake, Ind.		165	191	119
6.6	7.1	8.3	8.5	9.6	Cincinnati, O.	Hamilton, O.	122	232	207	135
29.2	47.4	51.2	52.8	59.2		Butler, O.		266	76	57
5.8	7.2	7.9	8.1	9.1		Warren, Ohio		14	47	11
9.2	10.9	12.1	12.0	13.7		Kenton, Ky.		30	31	21
5.0	5.4	5.5	5.7	6.4	Cleveland, O.	Cuyahoga	231	528	549	332
12.5	14.1	16.5	17.3	19.3		Geauga		16	26	19
7.6	9.2	10.7	11.0	12.3		Lake		75	59	21
12.9	15.2	17.2	18.3	20.5		Lorain		66	67	40
24.3	28.2	32.0	33.5	38.2		Medina		24	23	15
28.8	34.9	43.6	47.0	52.7	Columbia, S. C.	Richland	57	93	53	35
10.7	12.1	13.6	14.1	15.8	Columbus, O.	Franklin	124	261	338	225
27.4	32.8	38.1	40.6	45.5	Corpus Christi, Tex.	Nueces	105	163	144	96
36.5	41.9	48.2	50.8	58.1		San Patricio		76	80	50
13.5	16.0	17.7	18.2	20.4	Dallas, Tex.	Dallas	350	1278	853	501
8.2	9.2	9.9	10.4	12.0	Denver, Colo.	Denver	150	372	366	242
10.8	12.5	14.3	14.7	16.5		Adams		41	45	27
64.0	75.0	85.1	89.7	102.9		Arapahoe		27	37	24
21.8	25.0	28.0	29.5	33.1	Des Moines, Ia.	Polk	139	224	193	151
7.5	9.0	10.7	11.1	12.4		Dallas		32	33	25
5.8	7.7	9.0	9.2	10.3	Detroit, Mich.	Wayne	556	1183	940	534
5.0	5.6	5.7	5.8	6.6		Macomb		163	154	76
22.8	26.8	31.5	33.3	37.8		Oakland		234	298	202
27.6	31.3	35.9	38.8	43.4		Washtenaw		144	132	76
7.8	9.0	10.5	10.8	12.6		Monroe		81	79	41
20.4	24.6	30.6	31.6	35.4	El Paso, Tex.	El Paso	79	145	125	86
23.2	28.9	36.0	37.7	42.2	Evansville, Ind.	Vanderburgh	88	110	79	55
11.2	12.7	13.9	14.4	16.1	Ft. Wayne, Ind.	Allen	74	148	148	74
5.9	6.4	7.5	7.7	8.7	Ft. Worth, Tex.	Tarrant	463	641	471	277
5.2	6.9	7.9	8.1	9.1	Fresno, Calif.	Fresno	262	327	340	202
6.3	6.8	7.9	8.1	9.1	Dayton, O.	Montgomery	115	229	236	151
15.6	18.2	21.7	22.3	25.0	Grand Rapids, Mich.	Kent	154*	177	138	83
21.2	24.8	28.0	29.0	32.5	Great Falls, Mont.	Cascade	21	83	69	47
37.0	162.4	186.4	198.4	222.2	Greensboro, N. C.	Guilford	55	122	125	75
9.7	11.5	13.1	13.7	15.6	Harrisburg, Pa.	Cumberland	72*	102	88	59
18.2	21.5	25.2	25.8	28.9		Dauphin	65*	67	71	52
12.7	15.1	17.3	18.3	20.0						
9.2	11.0	13.1	13.5	15.2	Hartford, Conn.	Hartford	86	170	164	87
5.6	6.3	7.5	7.7	8.7	Houston, Tex.	Harris	206	606	608	396
6.2	6.6	7.7	7.9	8.9		Brazoria		54	65	35
35.4	41.8	43.8	41.8	48.2	Indianapolis, Ind.	Marion	161	346	357	236
14.6	17.3	19.9	21.0	24.0	Jackson, Miss.	Hinds	52	83	54	26
47.5	57.9	69.5	72.5	80.8	Jacksonville, Fla.	Duvall	107	227	207	85
4.0	4.4	4.8	4.4	4.9	Kansas City, Mo.	Jackson, Mo.	255	506	545	406
22.5	28.1	34.1	35.4	40.4		Clay, Mo.		25	25	11
9.7	10.9	10.8	10.2	11.4		Johnson, Kans.		36	32	13
11.0	13.0	15.6	16.2	18.2		Wyandotte, Kans.		52	62	50
5.5	6.2	5.9	6.2	6.9	Knoxville, Tenn.	Knox	76*	83	61	38
16.7	19.2	18.2	16.2	16.4	Las Vegas, Nev.	Clark	81*	101	106	61
9.9	11.3	12.6	13.0	14.5	Little Rock, Ark.	Pulaski	97	166	138	86
6.3	8.8	11.8	12.1	13.6	Los Angeles, Calif.	Los Angeles	1838	3510	3144	1751
16.7	19.7	21.2	19.5	21.8		Orange		287	244	145
9.3	10.8	12.5	12.9	14.4		Ventura		215	180	59
						San Bernadino		297	303	112
4.2	4.4	4.7	5.0	5.6		Riverside		257	199	108
36.2	42.5	50.0	52.5	60.1						
11.8	13.6	15.0	15.8	17.7	Louisville, Ky.	Jefferson, Ky.	77	209	158	102
12.3	14.1	15.4	15.5	17.8		Clark, Ind.		37	37	61
11.5	13.5	15.5	16.0	17.9		Floyd, Ind.		17	20	9
					Lubbock, Tex.	Lubbock	64	133	127	76
74.9	89.3	103.7	107.3	120.3	Madison, Wis.	Dane	66	113	131	95
7.4	8.0	9.3	9.6	10.7						
9.4	10.6	12.2	12.6	14.1	Medford, Ore.	Jackson	47*	72	68	46
17.5	21.1	25.7	28.0	32.1	Memphis, Tenn.	Shelby, Tenn.	208	347	232	130
15.4	17.9	19.0	18.9	21.1		Crittenden, Ariz.		50	44	21
7.3	8.0	9.6	9.9	11.1	Miami, Fla.	Dade	525	792	724	312
8.1	9.2	10.5	11.4	12.7		Broward		115	119	40
15.1	17.6	19.5	19.6	22.0	Midland, Tex.	Midland	38	53	75	65
20.6	25.1	30.3	31.6	35.4		Milwaukee, Wis.	207	405	364	244
10.3	12.7	15.0	15.5	17.3		Waukesha		83	89	59
7.3	9.1	11.4	11.7	13.1		Washington		61	88	55
20.2	23.6	26.4	28.0	31.3		Ozaukee		31	27	23
35.8	101.9	119.4	124.9	142.2						
7.7	8.5	10.2	10.6	11.8	Minneapolis, Minn.	Hennepin	352	398	435	286
10.9	12.7	14.3	14.7	16.4		Ramsey		271	214	143
						Anoka		15	22	16
3.3	3.5	2.7	1.7	1.3		Dakota		34	27	20
8.1	10.4	11.8	12.2	13.7		Washington		19	31	20

Norfolk, Va.
Oklahoma City, Okl
Omaha, Neb.
Orlando, Fla.
Pendleton, Ore.
Pensacola, Fla.
Philadelphia, Pa.
Phoenix, Ariz.
Pittsburgh, Pa.
Portland, Me.
Portland, Ore.
Providence, R. I.
Raleigh, N. C.
Reno, Nev.
Richmond, Va.
Roanoke, Va.
Rochester, Minn.
Rochester, N. Y.
Sacramento, Calif.
Saginaw, Mich.
St. Louis, Mo.
Salt Lake City, Ut.
San Antonio, Tex.
San Diego, Calif.
San Francisco, Calif.
Savannah, Ga.
Scranton-Wilkes Barre, Pa.
Seattle, Wash.
Shreveport, La.
South Bend, Ind.
Spokane, Wash.
Syracuse, N. Y.
Tampa, Fla.
Toledo, O.
Tucson, Ariz.
Tulsa, Okla.
Washington, D. C.
W. Palm Beach, Fla.
Wichita, Kans.
Worcester, Mass.
Youngstown, O.

TOTAL FOR 107 ARE
NATIONAL TOTAL
107 AREAS % OF N

[1] *1946 data did not be*
* *7-1-1946 data not av*

	17.6	20.6	23.9	24.4	27.0
Tex.	7.8	8.3	8.6	8.4	9.4
	51.0	59.6	67.7	70.9	79.4
	21.5	26.7	32.6	31.9	32.5
	26.5	31.4	34.8	36.0	40.3
	9.9	10.9	11.2	11.9	13.3
	30.5	38.5	50.5	54.9	63.2
	11.4	13.0	12.9	11.8	13.6
	8.6	10.3	13.4	14.2	16.6
	6.6	7.1	8.3	8.5	9.6
	29.2	47.4	51.2	52.8	59.2
	5.8	7.2	7.9	8.1	9.1
Mich.	9.2	10.9	12.1	12.0	13.7
t.	5.0	5.4	5.5	5.7	6.4
	12.5	14.1	16.5	17.3	19.3
	7.6	9.2	10.7	11.0	12.3
	12.9	15.2	17.2	18.3	20.5
	24.3	28.2	32.0	33.5	38.2
	28.8	34.9	43.6	47.0	52.7
	10.7	12.1	13.6	14.1	15.8
	27.4	32.8	38.1	40.6	45.5
	36.5	41.9	48.2	50.8	58.1
	13.5	16.0	17.7	18.2	20.4
	8.2	9.2	9.9	10.4	12.0
	10.8	12.5	14.3	14.7	16.5
if.	64.0	75.0	85.1	89.7	102.9
	21.8	25.0	28.0	29.5	33.1
	7.5	9.0	10.7	11.1	12.4
	5.8	7.7	9.0	9.2	10.3
	5.0	5.6	5.7	5.8	6.6
	22.8	26.8	31.5	33.3	37.8
	27.6	31.3	35.9	38.8	43.4
	7.8	9.0	10.5	10.8	12.6
	20.4	24.6	30.6	31.6	35.4
nn.	23.2	28.9	36.0	37.7	42.2
	11.2	12.7	13.9	14.4	16.1
	5.9	6.4	7.5	7.7	8.7
	5.2	6.9	7.9	8.1	9.1
n.	6.3	6.8	7.9	8.1	9.1
	15.6	18.2	21.7	22.3	25.0
	21.2	24.8	28.0	29.0	32.5
	137.0	162.4	186.4	198.4	222.2
	9.7	11.5	13.1	13.7	15.6
Okla.	18.2	21.5	25.2	25.8	28.9
	12.7	15.1	17.3	18.3	20.0
	9.2	11.0	13.1	13.5	15.2
	5.6	6.3	7.5	7.7	8.7
	6.2	6.6	7.7	7.9	8.9
	35.4	41.8	43.8	41.8	48.2
	14.6	17.3	19.9	21.0	24.0
	47.5	57.9	69.5	72.5	80.8
	4.0	4.4	4.8	4.4	4.9
	22.5	28.1	34.1	35.4	40.4
	9.7	10.9	10.8	10.2	11.4
	11.0	13.0	15.6	16.2	18.2
	5.5	6.2	5.9	6.2	6.9
	16.7	19.2	18.2	16.2	16.4
	9.9	11.3	12.6	13.0	14.5
	6.3	8.8	11.8	12.1	13.6
	16.7	19.7	21.2	19.5	21.8
if.	9.3	10.8	12.5	12.9	14.4
	4.2	4.4	4.7	5.0	5.6
	36.2	42.5	50.0	52.5	60.1
Ut.	11.8	13.6	15.0	15.8	17.7
x.	12.3	14.1	15.4	15.5	17.8
	11.5	13.5	15.5	16.0	17.9
alif.	74.9	89.3	103.7	107.3	120.3
	7.4	8.0	9.3	9.6	10.7
Barre, Pa.	9.4	10.6	12.2	12.6	14.1
	17.5	21.1	25.7	28.0	32.1
	15.4	17.9	19.0	18.9	21.1
	7.3	8.0	9.6	9.9	11.1
	8.1	9.2	10.5	11.4	12.7
	15.1	17.6	19.5	19.6	22.0
	20.6	25.1	30.3	31.6	35.4
	10.3	12.7	15.0	15.5	17.3
	7.3	9.1	11.4	11.7	13.1
	20.2	23.6	26.4	28.0	31.3
C.	85.8	101.9	119.4	124.9	142.2
n, Fla.	7.7	8.5	10.2	10.6	11.8
	10.9	12.7	14.3	14.7	16.4
	3.3	3.5	2.7	1.7	1.3
	8.1	10.4	11.8	12.2	13.7

Charleston, S. C.	Charleston	81		
Charleston, W. Va.	Kanawha	99*		
Charlotte, N. C.	Mecklenburg	134		
Chattanooga, Tenn.	Hamilton	95		
Chicago, Ill.	Cook, Ill.	762	1	
	Dupage, Ill.			
	Kane, Ill.			
	Will, Ill.			
	Lake, Ill.			
	Lake, Ind.			
Cincinnati, O.	Hamilton, O.	122		
	Butler, O.			
	Warren, Ohio			
	Kenton, Ky.			
Cleveland, O.	Cuyahoga	231		
	Geauga			
	Lake			
	Lorain			
	Medina			
Columbia, S. C.	Richland	57		
Columbus, O.	Franklin	124		
Corpus Christi, Tex.	Nueces	105		
	San Patricio			
Dallas, Tex.	Dallas	350	1	
Denver, Colo.	Denver	150		
	Adams			
	Arapahoe			
Des Moines, Ia.	Polk	139		
	Dallas			
Detroit, Mich.	Wayne	556	1	
	Macomb			
	Oakland			
	Washtenaw			
	Monroe			
El Paso, Tex.	El Paso	79		
Evansville, Ind.	Vanderburgh	88		
Ft. Wayne, Ind.	Allen	74		
Ft. Worth, Tex.	Tarrant	463		
Fresno, Calif.	Fresno	262		
Dayton, O.	Montgomery	115		
Grand Rapids, Mich.	Kent	154*		
Great Falls, Mont.	Cascade	21		
Greensboro, N. C.	Guilford	55	1	
Harrisburg, Pa.	Cumberland	72*	1	
	Dauphin	65*		
Hartford, Conn.	Hartford	86	1	
Houston, Tex.	Harris	206	6	
	Brazoria			
Indianapolis, Ind.	Marion	161	3	
Jackson, Miss.	Hinds	52		
Jacksonville, Fla.	Duvall	107	2	
Kansas City, Mo.	Jackson, Mo.	255	5	
	Clay, Mo.			
	Johnson, Kans.			
	Wyandotte, Kans.			
Knoxville, Tenn.	Knox	76*		
Las Vegas, Nev.	Clark	81*	1	
Little Rock, Ark.	Pulaski	97	1	
Los Angeles, Calif.	Los Angeles	1838	35	
	Orange		2	
	Ventura		2	
	San Bernadino		2	
	Riverside		2	
Louisville, Ky.	Jefferson, Ky.	77	2	
	Clark, Ind.			
	Floyd, Ind.			
Lubbock, Tex.	Lubbock	64	1	
Madison, Wis.	Dane	66	1	
Medford, Ore.	Jackson	47*		
Memphis, Tenn.	Shelby, Tenn.	208	3	
	Crittenden, Ariz.			
Miami, Fla.	Dade	525	7	
	Broward		1	
Midland, Tex.	Midland	38		
	Milwaukee, Wis.	207	4	
	Waukesha			
	Washington			
	Ozaukee			
Minneapolis, Minn.	Hennepin	352	3	
	Ramsey		2	
	Anoka			
	Dakota			
	Washington			

77	94	47		Middlesex, N. J.	....	96	79	46
118	86	31		Somerset, N. J.	....	42	55	34
				Fairfield, Conn.	....	210	185	89
212	164	96						
97	66	40	Norfolk, Va.	Norfolk	52	199	175	70
1321	1553	1055	Oklahoma City, Okla.	Oklahoma	188	339	363	235
116	179	109	Omaha, Neb.	Douglas, Nebr.	122	212	181	131
67	71	49		Pottawattamie, Ia.	....	41	38	29
89	74	44	Orlando, Fla.	Orange	142	200	133	76
148	178	85						
165	191	119	Pendleton, Ore.	Umatilla	45*	82	90	54
			Pensacola, Fla.	Escambia	35	56	47	16
232	207	135	Philadelphia, Pa.	Delaware Pa.	390	85	111	54
266	76	57		Montgomery, Pa.	....	197	199	129
14	47	11		Philadelphia, Pa.	....	306	277	161
30	31	21						
				Chester, Pa.	....	115	102	57
528	549	332		Bucks, Pa.	....	158	176	103
16	26	19		Camden, N. J.	....	132	118	83
75	59	21		Gloucester, N. J.	....	67	52	30
66	67	40		Burlington, N. J.	....	63	63	35
24	23	15						
			Phoenix, Ariz.	Maricopa	322	598	603	350
93	53	35	Pittsburgh, Pa.	Allegheny	212	376	397	198
261	338	225		Westmoreland	....	172	110	48
163	144	96		Washington	....	55	59	28
76	80	50	Portland, Me.	Cumberland	61	87	78	49
1278	853	501						
			Portland, Ore.	Multnomah, Ore.	213	487	375	235
372	366	242		Washington, Ore.	....	63	65	48
41	45	27		Clackamas, Ore.	....	55	50	32
27	37	24		Clarke, Wash.	....	85	64	30
224	193	151						
32	33	25	Providence, R. I.	Providence	105	96	88	41
				Kent	....	61	46	19
1183	940	534	Raleigh, N. C.	Wake	31	66	62	30
163	154	76		Durham	....	34	41	25
234	298	202	Reno, Nev.	Washoe	180*	144	158	72
144	132	76						
81	79	41	Richmond, Va.	Henrico	55*	136	152	91
			Roanoke, Va.	Roanoke	68	90	54	37
145	125	86	Rochester, Minn.	Olmsted	17	20	21	14
110	79	55	Rochester, N. Y.	Monroe	109	231	222	129
148	148	74	Sacramento, Calif.	Sacramento	167	297	250	134
641	471	277		Yolo	....	126	106	60
327	340	202						
			Saginaw, Mich.	Saginaw	64*	95	61	35
229	236	151	St. Louis, Mo.	St. Louis, Mo.	453	649	411	263
177	132	83		St. Clair, Ill.	....	170	195	125
83	69	47		Madison, Ill.	....	101	82	48
122	125	75	Salt Lake City, Ut.	Salt Lake	121	175	174	101
102	88	59						
67	71	52	San Antonio, Tex.	Bexar	186	450	427	275
			San Diego, Calif.	San Diego	347	713	653	400
170	164	87	San Francisco, Calif.	San Francisco	291	312	290	163
606	608	396		San Mateo	....	219	196	117
54	65	35		Napa	....	63	54	32
346	357	236						
83	54	26		Marin	....	53	62	37
				Contra Costa	....	148	165	92
227	207	85		Alameda	....	434	431	236
506	545	406		Sonoma	....	114	121	64
25	25	11		Solano	....	147	120	75
36	32	13						
52	82	50	Savannah, Ga.	Chatham	51*	103	88	37
			Scranton-Wilkes	Luzerne	82	52	45	26
			Barre, Pa.	Lackawanna	....	96	89	54
83	61	38	Seattle, Wash.	King	256	591	585	336
101	106	61		Pierce	86	158	178	105
166	138	86		Kitsap	....	60	70	36
3510	3144	1751						
287	244	145	Shreveport, La.	Bossier	86	5	40	21
215	180	59		Caddo	....	155	190	128
297	303	112	South Bend, Ind.	St. Joseph	113	153	149	98
257	199	108	Spokane, Wash.	Spokane	102	177	152	115
			Syracuse, N. Y.	Onondaga	83	149	146	88
209	158	102						
37	37	61	Tampa, Fla.	Hillsborough	67	125	119	69
17	20	9		Pinellas	....	154	139	93
133	127	76	Toledo, O.	Lucas	96	162	176	90
113	131	95	Tucson, Ariz.	Pima	43	190	162	91
			Tulsa, Okla.	Tulsa	179	524	465	323
72	68	46						
347	232	130	Washington, D. C.	D. C.	571	706	554	368
50	44	21		Montgomery, Md.	....	106	77	47
792	724	312		Prince Georges, Md.	....	269	107	53
115	119	40		Arlington, Va.	....	183	180	100
				Fairfax, Va.	....	34	57	38
53	75	65						
405	364	244	W. Palm Beach, Fla.	Palm Beach	124	163	186	88
83	89	59	Wichita, Kans.	Sedgewick	289	902	622	434
61	88	55	Worcester, Mass.	Worcester	227	269	237	155
31	27	23	Youngstown, O.	Mahoning	43	110	108	74
				Trumbull	....	71	76	44
398	435	286	TOTAL FOR 107 AREAS (209 COUNTIES)		18,829	42,640	39,807	23,543
271	214	143	NATIONAL TOTAL		51,088	94,910	87,762	53,173
15	22	16	107 AREAS % OF NATIONAL TOTAL		36.9%	44.9%	45.4%	44.3%
34	27	20						
19	31	20						

1946 data did not break down metropolitan areas by county.
** 7-1-1946 data not available—1-1-1947 used alternatively.*

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R. L. Anderson | Harold Archer | Russell Biegel | Earl Koehler

New field service force for Champion.

engine hours of operation recorded. The Navy too finds fewer spark plug removals with the use of TCP in its basewide operation at Corpus Christi.

Although the airlines in general have completed TCP testing and plan no further evaluations, by their continued interest alone one gets the impression that this is not a dead issue. Strong feelings persist in some quarters that there is a definite place for TCP in airline engine operation, and that TCP may well come into the picture in the present trend toward use of 25° spark advance and leaner long-range cruise operations.

Along with the military plan to test TCP in Boeing C-97 airplanes to iron out the turbosupercharger contamination problems that arose with its use at Northwest Airlines last year, United Air Lines is getting under way testing confined to its San Francisco base operation. Wright Aeronautical Division of Curtiss-Wright is also beginning a plant model test of TCP for the R-3350 Turbo-Compound engine this month, and the company is ready to sanction its use at the will of the operators.

Engine Analyzers: Expanded use of engine and ignition analyzers now being produced by the Sperry Gyroscope Co., Bendix-Scintilla and Land-Air, Inc. was evident from operator reports at the conference. National Airlines and Trans-Canada both recorded good success in the use of the voltage control feature of the Bendix unit in locating marginal spark plug operation.

The major area of growth in analyzer operation, however, has been in the direction of shop application. Eastern, Pan American, Northwest, TWA, Continental, Trans-Canada, and United all reported success either with the analyzer itself in test cell work, or with an equivalent Dumont oscilloscope for magneto bench testing of prematurely removed or newly overhauled magnetos.

At Trans-Canada, according to Ray Farren, within a period of five months the use of the analyzer on the magneto test bench resulted in the detection of 30 defective magnetos that otherwise would have been placed in service. Philippine Airlines' J. H. Kinkade told of PAL's successful use of the Sperry analyzer with vibration pickups on the R-2800 engine test cell to study valve performance after engine build-up and to detect even minor cases of improperly adjusted valves.

From the conference discussions airborne use of analyzers by major domestic airlines remains an arbitrary subject. Both American and United have purchased analyzers and are restricting their use to ground trouble-shooting. Although operators such as Capital, National, and Philippine Air Lines report good success, the feeling still prevails in some quarters that their use by the crew in flight can become costly, particularly by bringing what otherwise would be undetected minor difficulties into the category of required maintenance items to be corrected at the next landing.

Cleaning & Testing: Two new cleaners, a foreign unit produced by the Lodge Spark Plug Co. of Rugby, England, and another soon to be made available by the Vapor Blast Manufacturing Co. of Milwaukee, Wis., drew lengthy discussion.

The Lodge cleaner, as described to the group by H. E. West, chief electrical engineer for Roll-Royce, Ltd., will clean up to 36 plugs simultaneously and uses a solution of three pounds of ammonium acetate per gallon of water heated to 80° C. The solution is pumped from a manifold in the side of the cleaner into four tubes each having nine jets and providing a 12 pound injection pressure into the plug bore at close range. Average cleaning time under normal conditions was said to be 15 minutes, with 20 minutes required for heavily carboned plugs.

The Vapor Blast Cleaner, discussed during last year's session, was reported in the final stages of development and is described as being in the $1000 price range suited to the commercial airlines. It uses an abrasive suspended in liquid and will clean two plugs at a time, requiring 15 to 30 seconds per operation. The production cleaner will be available in about three months. Final price of the unit will depend on the volume of production requested, the conference was told.

In other conference developments, discussions centered around:

Low Tension Distributor Difficulties: Airline practice to combat distributor collector plate and brush burning in R-2800 and R-3350 engines ranges from no service whatever between overhauls to periodic replacement of distributors as frequently as each 350 hours. Most airlines use a periodic inspection procedure where the units are checked on an average of every 400 hours. The manufacturer, Bendix-Scintilla, reported an intensive investigation of the problem, but inability so far to reproduce the difficulty in the laboratory. Scintilla did place hope in distributor fingers of new design now undergoing test with the engine manufacturer and soon to be released for airline testing.

Field Service: An extensive expansion of Champion's aviation field service force designed to bring the experience of customers to the prompt attention of its engineering and research divisions was announced. Under the direction of service manager R. L. Anderson, former director of engineering of Delta-C&S Air Lines, a three-region organization has been set up with Harold Archer, ex-National Airlines engineer, in the east; Russell Biegel, former ignition specialist with the USAF Strategic Air Command, in the midwest; and Earl Koehler, former United Air Lines ignition engineer, in the west. • • •

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Arinc Calls for New Equipment Features

Characteristics of communications and signalling devices recommended by Aeronautical Radio group.

SETTING ITS SIGHTS on the early solution of airline operating equipment requirements of the next few years, the Aeronautical Radio, Inc. Airlines Electronic Engineering Committee last month passed on a revised equipment characteristic for VHF communications transmitters and receivers.

The action highlighted a three-day session held in Kansas City, Mo., which saw the growing industry interest in AEEC activities evidenced by the largest attendance (over the 100 mark) yet recorded.

In other meeting developments the committee:

• **Recommended** an initial equipment characteristic for SelCal, a ground-to-air coded calling system for airline company communications use. It does away with the extended monitoring of frequencies by crew members on long overwater flights.

• **Heard the report** of an embryo version of the AEEC, now being spearheaded by Ulf L. Johansson, Scandinavian Airlines System. The group is made up of SAS, Air France, SABENA, KLM, and Swissair.

Although neither of the new equipment characteristics (the revision for VHF communications equipment and the new selective calling system) will become official documents until they are passed on by the Arinc board of directors and are submitted to member airlines for a 30-day acceptance period, the recommendation of the committee is usually a key step in the acceptance procedure.

The VHF equipment characteristic being supported by the group is basically a recognition of a possible airline need for an Air Traffic Control Signalling System (ATCSS) and Double Channel Duplex (DCD) operation at a later date. As to equipment performance, the principal requirement set down by AEEC concerns the control of spurious radiation from the transmitter and spurious responses of the receiver.

As in the case with all AEEC equipment projects, the progress of the revised VHF equipment requirement has been closely coordinated with manufacturers throughout its development, through attendance at AEEC committee and sub-committee meetings. Representatives of the two manufacturers of Arinc-specification VHF communications equipment—Bendex Radio Division and Collins Radio Co.—have indicated belief that at least the majority of the new provisions can be introduced by minor changes to existing sets, subject, of course, to the wishes of the customer.

The selective calling system, originally termed Selsig but now renamed SelCal to avoid conflict with other signalling system designations on the horizon, is patterned after one developed by Pan American World Airways. It is adapted from the Motorola "Quick-Call" system and was described at length during AEEC's June meeting (AMERICAN AVIATION, July 6).

Airline interest in the system is by no means restricted to overwater operators; need for similar equipment has been expressed by domestic airlines to permit ready contacting of flights operating in high traffic areas, without having to resort to the bothersome and time consuming routine of notifying the crew of desire to communicate through CAA-ARTC communications.

Strong Interest

Using SelCal, the company station will merely transmit a coded signal which actuates a visual or aural device in the cockpit, thus advising the crew that communication is desired. Strong manufacturer interest in this AEEC activity was displayed at a special meeting called after the June session, with Bendix Radio, Motorola, Collins, Federal Telephone & Radio, Lear, and the National Co. having representatives attending.

The possibility that a European counterpart of AEEC will come into being looks promising, although work to date has been on the basis of an informal organization, pending approval of the managements of the participating airlines.

Although foreign airline participation in AEEC committee meetings has always been strong, even greater benefits could be expected from the coordination of AEEC activities among foreign operators through the medium of a permanently established European committee.

In other developments at the Kansas City session, the group discussed:

VOR TEST SIGNALS: CAA and Eastern Air Lines have negotiated an agreement on the operation of a VOR test signal at Miami International Airport, viewed as the probable forerunner of a number of similar installations to be made throughout the country. Under the contract CAA handles the licensing of the facility and disseminates information on its existence through listing in the Airman's Guide.

Eastern Air Lines' obligation is to operate the facility 24 hours a day and to maintain it within an accuracy of ± one degree during a monitoring period of 7:30 am to 4:15 pm daily, except Saturdays, Sundays, and holidays.

RADIO RACK COOLING: Douglas Aircraft Co. reported on extensive testing of a mock-up DC-7 radio rack, and conclusions drawn point to an obvious need for rack cooling systems for future aircraft. The report indicated that:

• **For cooling purposes,** the complete radio rack must be considered as a system, rather than as a group of components judged singly by bench tests.

• **Cooling through careful location** of equipment in a rack is impractical. Douglas found this to be true regardless of the care used in rack design and irrespective of the volume of air used for cooling.

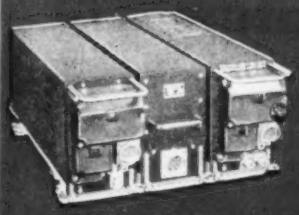
• **Tentative conclusion** was that for efficient cooling about 30 pounds of 80° F. air per hour would be adequate for 100 watts of power.

• **Cooling ducts cannot be confined** to units which would be affected by operation at high temperatures. So-called hot units can have a serious effect on adjacent equipment which would otherwise run fairly cool if operated on a bench.

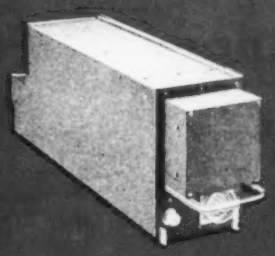
• **High heat-producing units** call for particular consideration so that concentrated heat energy is removed from the rack area.

Although the Douglas work on rack cooling is not completed, the path it will follow in the future appears to rest with airline interest in finding a solution to the general rack cooling problem. There is no question but that AEEC support of the Douglas work is unanimous, and it would not be at all surprising if individual airlines took it upon themselves to impress upon the Douglas Co. just how serious they consider the problem and how important it is that its research project be continued to a successful solution.

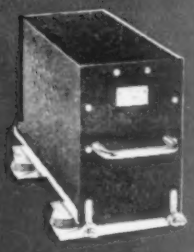
AIRBORNE RADAR: Final report of United Air Lines on its test program with RCA-built 5.7 cm equipment is now in preparation, and conclusions should be announced at or before the next AEEC meeting in Washington, D. C., in February, 1954. • • •



Type 440
VHF Airborne
Communications System
Receiver
Power Supply • Transmitter
180 Channels 118-136 mc/s
50 watts output



Type 429
Glideslope Receiver
A dual conversion superheterodyne receiver providing highly reliable ILS aircraft navigation



The CAT
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Low cost device for insuring accurate ILS approaches. Relieves pilot pressure at most critical point of let-down

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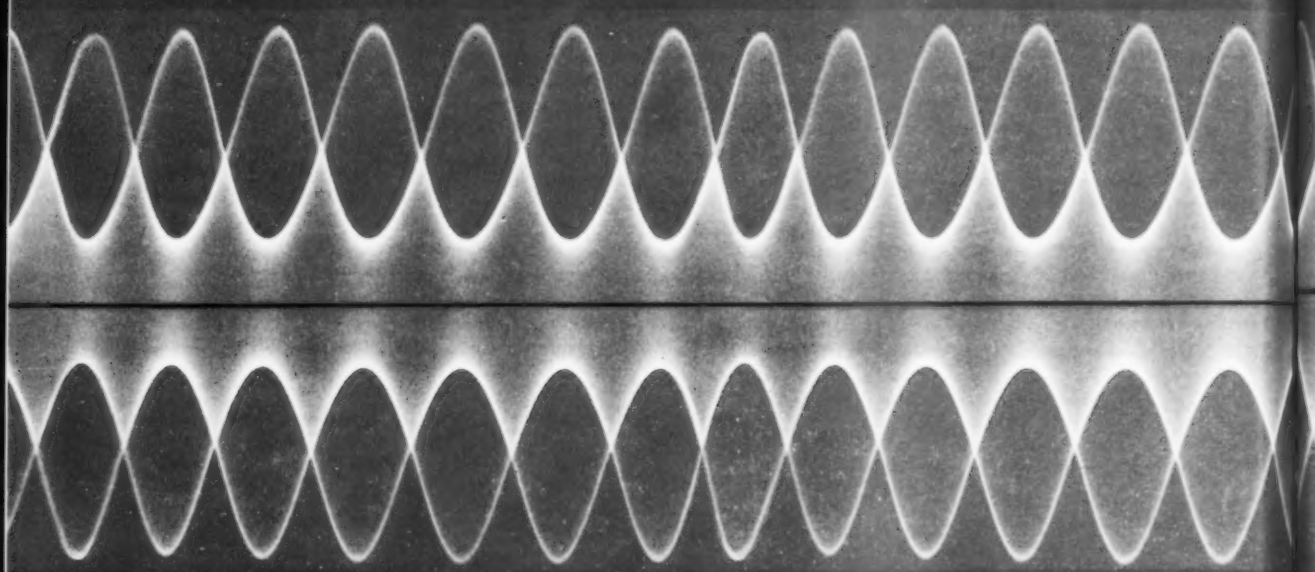
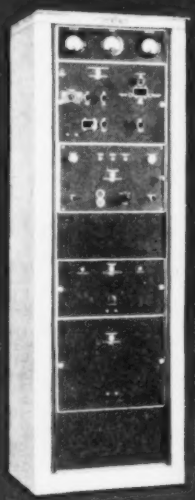
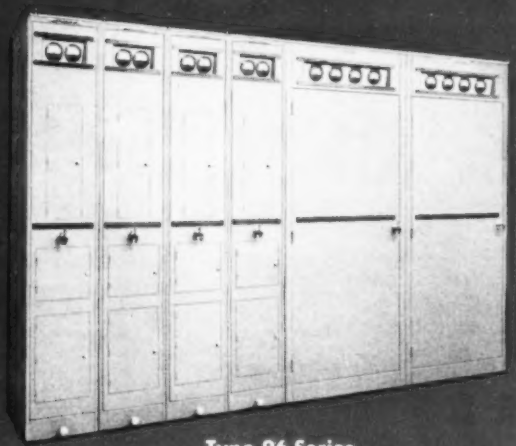




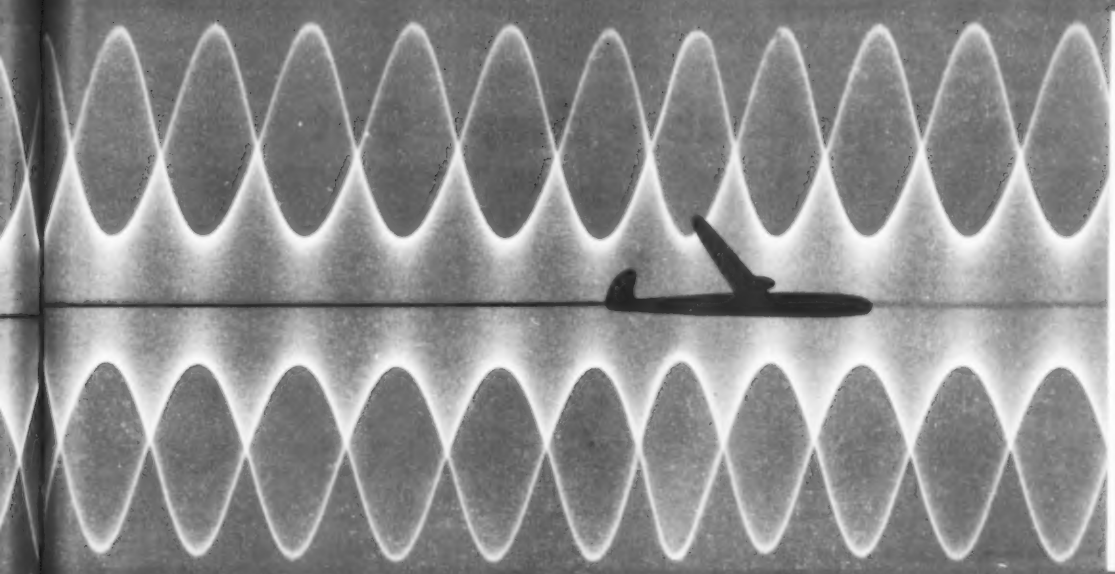
Type 396
Transmitter Station
Single channel
250 watts • 118-132 mc/s
Maximum dependability
for unattended service

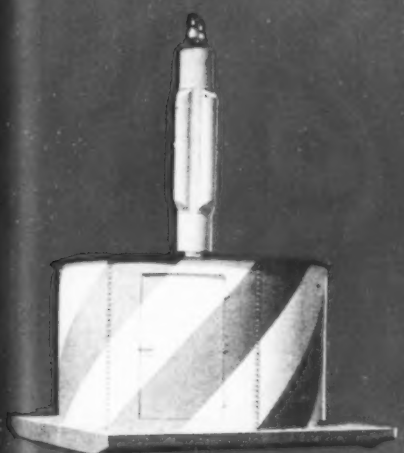


Type 96 Series
Transmitting Station
96D Transmitter 2500 watts, 2-26 mc/s
96-200C Transmitter 2400 watts, 125-525 kc/s
50H Modulator • 36D Rectifier

Type 428
Packaged Complete
VHF Station
Receiver: Type 305A
Transmitter: Type 406A, 50 watts output
Nothing else to buy

KEEP YOU FLYING . . . SAFELY!





Type 482 TVOR • Type 483 VOR Terminal VHF Omni-Range Unit

Low cost answer to improved safety and regularity of operation under adverse weather conditions

Type 99 Multi-Frequency Transmitter

Provides any combination up to four R.F. channels for operation 125-525 kc/s, 2-20 mc/s, 400 watts; and 118-152 mc/s, 250 watts

Whoever you are, wherever you fly—the signals from Wilcox equipment will help you get where you're going and help you land . . . *safely*.

What's more, Wilcox equipment has been helping scheduled, non-scheduled, government airlines—here and abroad—fly safely for more than 21 years.

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Prototype of the Super Sabre was shown to press as first production model rolled out. More than 100 hours have been logged on the YF-100 since last May. Distinctive feature is one-piece ("flying") horizontal stabilizer set extremely low on fuselage. Drag chute shortens ground roll on landing.

The Super Sabre Steps Out

Squared-off fuselage cross-section is noticeable in photo above, and more so in view below. Wings and tail are swept 45°. Chunky rear section of fuselage encloses afterburner for the Pratt & Whitney J57-7 engine. Larger than most fighters, the F-100 is 45 feet long, 14 feet high, and has wingspan of 36 feet. Service ceiling is over 50,000 feet, combat radius over 500 nautical miles. Titanium is used extensively throughout.

A MILITARY COMMENTARY . . .

New Military Interest in Turboprops

FOR THE FIRST TIME since the advent of the turboprop engine, the Air Force and the Navy's Bureau of Aeronautics have set up a comprehensive development program which includes service testing of these engines in a number of transport and combat type aircraft, in which they now are in process of being installed.

The significant point here, it appears to this observer, is that at long last the Air Force and the Navy seem to agree that military air transport, in this largely jet era, should make a vigorous attempt to develop along lines not too far behind combat aircraft, so far as speed is concerned.

Here we have a combat Air Force and a combat naval aviation ready to go anywhere in the world and do battle at jet speeds. At the same time we have a supporting military air transport service tagging along behind at piston-engine speeds. It doesn't make sense, from a military standpoint.

Behind the Civil War

Actually, so far as our military air transport is concerned, we have dropped behind the requirement of the Civil War: that the supply train, the ammunition wagons, the field kitchens, keep up with the army.

Our present aerial supply train can't come anywhere near keeping up with our combat air forces. Not that it ever will actually fly as fast as the fighters and the bombers—it doesn't need to. But it shouldn't be too far behind, or it will slow down the air war. In fact, aerial combat in a distant theater of operations cannot start until the maintenance personnel, the ammunition and bombs, the supplies, the spare parts, and the gasoline and oil get there.

Take a SAC wing, for instance, ordered to begin operations in a part of the world where it has little or no facilities. Korea offers a case in point. The war started suddenly and unexpectedly. There was practically nothing there to begin with. Everything had to be flown in. Later on, of course, much would be brought by ships. But at the start of hostilities, the air was the only highway of supply. It will be the only fast supply line in the next war, wherever it breaks out.

So SAC sends off its wing of bombers and fighters, say half way around the world. It gets there. . . . And then it sits on its tail until the old reliable C-54's C-124's and C-97's come slogging along with everything it needs to get into action. That's a day or two later.

More probably, of course, the combat wing will sit down en route, and wait for its supply train to catch up. Then it will go on, with the train not too far behind on the last leg of the flight. This, it is humbly submitted, is not the ideal way to fight an air war in the era of the speedy jets.

So let's try to modernize the supply wagons, Air Force and Navy say in unison. Let's get the turbine transports moving. That appears to be the general idea, and it's a good one.

Two Answers

Jet engined transports are one answer, and turboprop-engined transports are another. Each has its peculiar advantages—and disadvantages. The purpose of these coming Air Force and BuAer service tests is to determine the status of the turboprop engine at this stage of its development.

The turboprop has been the Cinderella in the engine family—it's been left in the kitchen. This situation came about, not through any lack of Navy-Air Force interest, but purely as a result of the Truman-Johnson economy policy of 1946 and 1947, when all development funds were drastically cut.

Because of the money shortage it was decided by the Department of Defense that the Air Force should concentrate on jets while the Navy took over turboprop developments. Thus, until recently, this engine type was very largely a Navy responsibility. Now both Air Force and Navy are cashing in on a coordinated program.

Because of lack of money for development work, the United States lags behind Great Britain so far as flight experience with turboprops is concerned. Britain has piled up over 5000 experimental flight hours, while the United States has no more than 500 or 600 hours. However we need more shaft horsepower than the British thought necessary, so we designed for it. They consequently have far more flight experience with the smaller turboprops, and we have more flight experience with the bigger jobs.

"In-Between" Engines

Air Force and Navy BuAer spokesmen closely connected with the coming tests seem enthusiastic about the prospects of these "in-between" engines, which lie in a category somewhere between piston engines and pure jets. They operate most efficiently and economically at heights and speeds where piston engines and jets are relatively less efficient—in the 20,000- to 30,000-foot altitude range and at speeds of 400 to 500 miles per hour.

Here's the box score for the Navy and Air Force

The turboprop: 'the workhorse class'

at the present time: the Navy has ordered two Lockheed Super Constellations with P & W T34 engines. This plane is known as the R7V-2. The Navy still has a number of Convair R3Y flying boats on order with four Allison T40's. The Navy's Convair XP5Y-1 flying boat with four Allison T40's was the predecessor of the R3Y.

The first of these long range transports crashed; the second and last nears completion. The crash, incidentally, was not due to engine failure but to control trouble, the Navy says.

The Navy has moth-balled two North American Aviation A2J Savage attack bombers with two Allison T40's. When they were completed, the Navy put them in "long term preservation" to conserve scarce research and development funds, the spokesman said.

The Navy recently cancelled production plans for the T40 powered Douglas A2D Skyshark.

The Air Force has ordered two Convair 340's converted to Allison YT-56's and two Boeing C-97's fitted with P & W T34's. The Navy had ordered four Lockheed Super Constellations fitted with P & W T34's, but let the Air Force have two of them—evidently in a spirit of integration and brotherly love.

The Air Force has ordered one Douglas Globemaster II (C-124) fitted with P & W T34's. This will be the YKC-124B. The production version of the turboprop powered C-124 will be known as the C-133. The USAF also has ordered Lockheed's C-130A assault transport with four Allison T56's into quantity production.

Republic is said to be building four F-84H turboprop test beds—two each for Air Force and Navy—with several advanced turboprops including the C-W T49. Not announced; and Air Force and Navy say, "No comment."

As to the engines, thrust horsepower of most of them is classified, so figures used here are "estimated." Webster says an estimate is "a judgment made by calculation, especially from incomplete data; a rough or approximate calculation." So don't place any bets on the accuracy of these estimates. Go to the $2 window.

Pratt & Whitney produces the T34 and T52. The T34 has 5500 shaft horsepower. The Allison T54, formed by coupling two T56's, produces 7500 horsepower. The Curtiss-Wright T49, based on the J67, produces 8500 horsepower. The C-W T47 is said to produce 10,000 shaft horsepower.

It is reported (but not confirmed by Air Force) that two C-W 49's are to be installed in a Boeing B-47D in place of the four inboard jet engines, leaving the two outboard jets where they are. The plane will be used as a flying test bed to test the use of turboprops on a swept-wing airplane.

Probably it doesn't need repeating, for nearly everyone in aviation must know it, but a turboprop engine is simply a jet engine driving a geared-down propeller, or propellers. As the jet compressor turns at high speed, it has to be geared down to turn the propellers at their most efficient speed. Usually there are two contra-rotating propellers.

The turbojet engine alone, without this propeller hook-up, would be inefficient below the neighborhood of 30,000 feet and at low speeds. But the propeller, with variable pitch blades, gets a bite on the air and serves to pull the aircraft while the jet pushes. It is this jet-propeller combination that finds its most efficient operating height in the 20,000- to 30,000-foot range, where both the pure jet and the piston type engines are least efficient.

The reason for the interest in turbojet engine development lies in the fact that the piston engine has about reached its limits in the production of horsepower. Adding a turbine driven by exhaust gases gives it more power, but it seems probable to engineers that it will remain in the 4000-horsepower-per-unit class.

Making the engine bigger, while it would increase its power, also would increase its frontal area, which would mean increased drag. Furthermore, in a bigger engine the problem of heat distribution would increase.

The turboprop engine now can turn out 7500 horsepower or more with a much smaller frontal area on the engine, thus reducing drag. It burns a cheaper grade of fuel, and although it burns more of it, the operating costs are said to be comparable with those of the piston engine type.

Why Not Turbojets?

It may be asked, why not turbojets instead of turboprops? The answer is that they are most efficient at high altitudes and high speeds over long distances. They are greedy fuel consumers on the way up to their best operating height, though economical when they get up there. To fly jet-powered airliners across the continent with stops every 250 miles would break any airline, or at least cut its profits materially.

The two points in favor of the turboprop are that we get very high shaft horsepower and all the benefits of a propeller, housed in a relatively small package with small frontal area compared to the piston engine. The combination of the two points above give the turboprop engine great utility in accommodating itself to heavy load take-offs from small fields, and automatic braking—through the propellers—when landing.

A transport plane powered by turboprop engines can take off in half the runway length required by a jet transport, and can come to a stop with half the jet's run. In short, it's a utility plane-engine combination in the medium high speed, medium altitude class—the workhorse class.

. . . Cy Caldwell

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MULTI-UNIT IBM Model 701 computer, as set up at Douglas-Santa Monica.

Calculators Speed Engineering Projects

Electronic "brains" make possible vast amounts of detailed analysis; use spreading rapidly.

COMPUTING MACHINERY has become as indispensable to the aircraft industry as the wind tunnel. Important new advances in the aeronautical engineering art are being accomplished as the scope and magnitude of machine computing expand. Economies in time are little short of phenomenal.

As one example:

Using its latest whopper in digital computers, IBM's new Model 701 electronic data processor, Lockheed Aircraft Corp. came up with the mathematical answers to a complex 16th order flutter problem in half a week elapsed time. F. P. Cozzone, manager of Lockheed's mathematical analysis department, estimates the cost of the job at $5,000.

Using four desk calculators, it would have taken 66 weeks to have processed the same equations without the help of the 701. The cost would have been approximately $26,400, Cozzone estimates.

A striking example of how machine computing affects design is the flooring in the big C-124 transport being produced by the Long Beach division of Douglas Aircraft Co.

The flooring is supported by four longitudinal beams fabricated of magnesium. This represents the first use of magnesium beams in this manner by Douglas. It resulted from the complete, precise analyses the Douglas stress group was able to make of the concentrated loads the flooring might be called upon to support in transporting the wide variety of heavy equipment the military wanted to carry in the big plane.

Airplanes are complicated to design and difficult to build and they are filled with critical engineering problems like flutter. Higher flight speeds and the thin airplane and missile surfaces of modern high-speed design make the flutter problem more acute than ever. Flutter also is difficult to deal with mathematically. Digital machine computing methods have been of enormous benefit.

"Our flutter engineers aided by machine computing have dealt with more flutter investigations in the last few years than they would otherwise have seen in a lifetime," says Charles R. Strang, chief strength engineer for the Santa Monica division of Douglas.

IBM's No. 701 defense calculator right at this time is grabbing off the biggest share of the computing machine spotlight in the aircraft industry because of the recent installations at the Santa Monica division of Douglas and at Lockheed. Lockheed is already operating two 40-hour shifts on the machine and is considering adding a third. Douglas has ordered a second 701 for its El Segundo division. North American Aviation has just taken delivery of a 701 at Los Angeles, and Consolidated Vultee has one coming at San Diego.

The 701 dwarfs IBM's earlier computers as the DC-7 would a DC-2. This machine—which adds and subtracts 16,666 times a second or multiplies or divides 2192 times a second and "memorizes" more than eight million digits—is a multi-unit affair of impressive proportions. The apparatus fills a fair-size room and there's enough heavy cabling to equip a sub-station.

It's not only big, it's also sensitive. A voltage regulator isn't enough to insure uniform power supply and an installation involves separate generators for it alone. It comes complete with IBM service representatives.

Following IBM's standard practice, the equipment is not sold, but is installed on a monthly fee basis. Rental cost of a 701 is $15,000 a month per 40-hour shift. A second 40-hour shift ups the rental to $20,000 a month. This means Lockheed is paying at the rate of $240,000 a year for machine rental alone in adding this modern improvement to its engineering facility. After the second machine is installed at El Segundo, Douglas will be paying out a minimum of $360,000 a year on rental on this one type of machine.

Parameter Changes

Like the digital equipment, advances also are being made in the analogue computers which have come to be so handy for screening out things in preliminary design. The analogues are ideal for working out early stage problems, since it is easy to change the values of the parameters in which you are working.

An imposing feature of Lockheed's growing computer center is a $130,000 mass of electric circuitry representing the Caltech-designed network analyzer manufactured by the William Miller Corp. of Pasadena. There are other Miller analogue computers at Douglas El Segundo, and at North American.

A new decimal digital differential analyzer has just been put on the market by Computer Research Corp. of Hawthorne, Calif. Called the CRC 105, it makes talented use of integrators to operate in the decimal number system in contrast to the more complex binary numbers.

First application of this machine in the aircraft industry was at Lockheed, where it was put to work verifying gust load studies on the Super Constellation. Next trick—analyzing gust loads on Lockheed's jet transport.

The CRC 105 sells at $57,500, or rents at approximately $3,000 a month, including service. North American also has a CRC-105-type analyzer.

If Los Angeles hasn't become the computing center of the world, it is the next thing to it. All of the airframe manufacturers have established computing centers named by personnel having backgrounds in classical mathematics and physics, and they're accomplishing savings in engineering time counted in

Should the need arise again, the Cougar jet fighters above, plus other new Grumman Aircraft, will play as big a role in victory as did Panther jets in Korea . . . as did Grumman Wildcats, Hellcats and Avengers of task force fame in World War II.

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thousands of hours.

Computing expansion has been very fast. Only five years ago Douglas had less than 500 square feet of floor space devoted to computing equipment. Today its machines take up more than 12,000 square feet and the end is not in sight.

When Lockheed installed its IBM 701, it required a major alteration job in its brand new engineering building at Burbank. The architects had made provision for everything else, but computing machinery was something they hadn't heard of. It's an item, however, that's sure to attract prominent attention in the architectural design of any aircraft engineering buildings of the future. • • •

Southwest Load Factors Hit 63%

System load factors of Southwest Airways have jumped from 54.1% in May to 63% in August, the first four-month period of the carrier's mixed-fleet operation using Martin 2-0-2's and Douglas DC-3's, according to SWA's president, John H. Connelly.

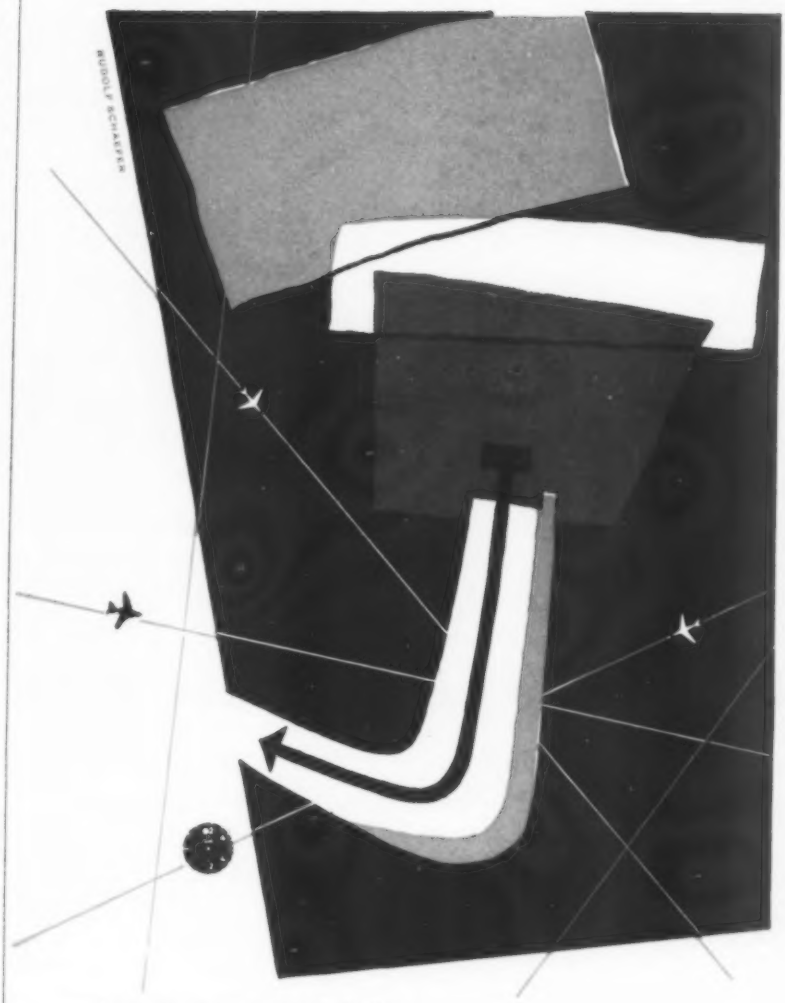
Further, Connelly estimates, the use of Martin aircraft has "stimulated loads carried by the DC-3's."

The CAB, terming the mixed-fleet experiment a "risk of management" project, has refused any higher mail pay to SWA than would have been required had an all DC-3 operation been continued. This was in line with the Board's findings in the Pioneer Air Lines Case, where that carrier lost out on a mail rate bid for an exclusive 2-0-2 operation.

Connelly, explaining the progress of the first four months, said: "The high load factors were not achieved through scheduling the Martins on the best flights only, as we purposely experimented during this period by switching the Martins around to various flights.

"The results were always the same—wherever Martins were scheduled, those flights developed high loads, and in addition, the flights that reverted to DC-3 equipment did not lose completely all of the gains achieved while they were Martin flights."

The SWA head said also that from a maintenance standpoint, "the Martin is unusually trouble-free, and that, as we have become more experienced with the airplane, the maintenance costs have steadily diminished."



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KLM'S FIRST DC-6A won last month's London-New Zealand air race (transport handicap section), covering 12,675 miles in 49 hours and 57 minutes. With 5000 cubic feet capacity, the DC-6A can carry 10 horses, cloth to mak e 5000 suits, machinery weighing up to 11 tons.

Cargo Success Requires Rate Revision: KLM

Freight brings in 30% of carrier's trans-Atlantic revenues; airline led in 1952 Atlantic cargo volume.

By ANTHONY VANDYK

AMSTERDAM—There were 30,002 passengers on a recent flight here from New York—30,000 baby chicks, a German sheepdog, and a veterinary to look after them. There was also a full-length Cinerama screen, plus the usual collection of packages and crates, which are becoming almost as common at airports as they are at railroad and truck depots.

This type of load is routine for KLM Royal Dutch Airlines, which ranks as one of the world's top freight-carrying airlines thanks to the efforts of a management which is more actively cargo-minded than most.

In 1952 KLM took first place among the foreign carriers for volume of freight transported across the Atlantic—four million pounds eastbound and three million westbound. Over 30% of the airline's gross revenue from its trans-Atlantic services comes from cargo, which yields a tidy profit (the entire KLM cargo operation is in the black).

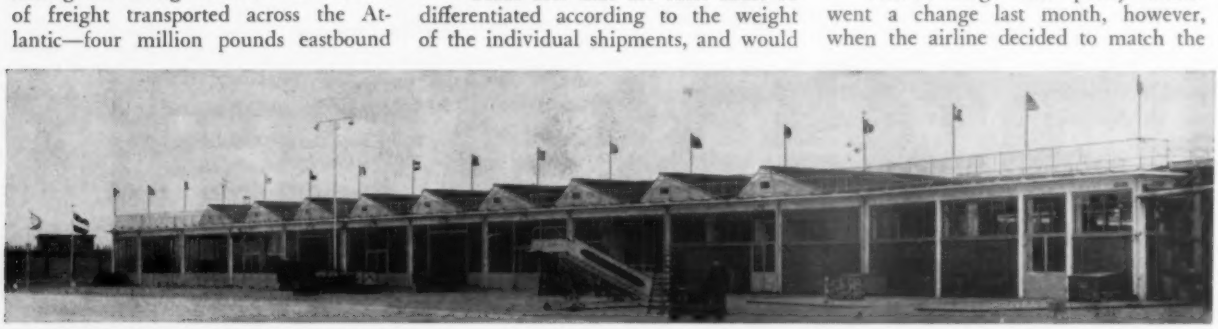
At the moment the trans-Atlantic cargo situation is of great interest, since the presently-agreed-upon rates of IATA members expire on November 16. Explaining the situation, Alvin E. Levenson, cargo sales manager for KLM's North American Division, says: "In order properly to develop the enormous cargo potential on the North Atlantic route, it is not sufficient to create capacity, but to reduce and revise the cargo rate structure. There are two schools of thought on the most efficient and sound way of editing rate structures.

"Some feel that the rates must be differentiated according to the weight of the individual shipments, and would add to the already existing discount of 25% for shipments of 100 pounds or more a new discount of 45% for shipments of 1100 pounds or more; at the same time the majority of the current commodity rates would be withdrawn.

"KLM," Levenson says, "does not agree with this theory. We feel and have found from experience that individual shipments of 1100 pounds or more are relatively rare. Consequently, the shippers would not get the fullest benefit of the reductions made possible by the introduction of new equipment. We feel that cargo rates must be differentiated per commodity in the same way as has hitherto been done by means of specific commodity rates."

KLM believes that new and greatly reduced specific commodity rates must be introduced with low minimum weights in order to broaden the air cargo market and to tap untouched sources of trans-Atlantic air cargo.

KLM's cargo rate policy underwent a change last month, however, when the airline decided to match the



STREAMLINED CARGO-HANDLING is featured in KLM's $450,000 freight building at Amsterdam's Schiphol airport.

OUTBOUND CARGO in KLM'S freight building at Schiphol airport, Amsterdam, is classified according to destination. Loads are distributed on pallets for shipment.

reduced general cargo rates to be introduced by Pan American World Airways, its main competitor in the freight field, on November 16.

Explaining this action, a KLM official stated that KLM would have preferred to wait until the whole matter had been thrashed out at an IATA conference but could not do so in order "to remain in the competitive market." However, he said, "KLM is still confident that the best way to attract new and greater volumes of air cargo is by . . . specific commodity rates differentiating commodities and granting lower minimum requirements."

If an open rate situation develops, KLM will introduce an entirely new commodity tariff which is already prepared, the official disclosed.

KLM realizes that the major costs of the air cargo business are in direct relation to the number of small consignments handled and believes that both carrier and customer will benefit from drastic reductions in freight rates, which will increase volume and cut unit costs. Nevertheless, the Dutch airline's policy is to play down the cost factor, feeling that what it offers in the field of transportation possesses its own characteristics and therefore its own price. In the words of KLM's president, Dr. Albert Plesman: "We can afford to ask for a higher price because we offer something special."

Plesman, like all KLM men, is a realist and admits that "despite all the pleasant forecasts . . . air cargo is still in its infancy" and that much has to be done to persuade shippers to use air transportation.

To date shippers who have used KLM have done so mainly because of the time available for delivering the goods; in other words they have been buying speed. The time element in air cargo is frequently determined by the nature of the goods (perishables, fruit, vegetables, etc.); in other cases by an emergency factor (spare parts for ships or factories); or even by the terms of contracts which stipulate that the first deliveries will go by air and that the remainder of the goods under contract will be shipped afterwards by other means.

Plesman stresses the point that air carriers are selling a saving in time and that the basic argument will help the promotion of air cargo. He says: "The more we can sell the idea of bringing markets nearer to the home base of production—by using the air routes—the more successful it will be in promoting the growth of air cargo."

In keeping with its policy of buying the best available aircraft for each type of operation, KLM has purchased two Douglas DC-6A's—it was the first European airline to do so—to supplement the DC-4 freighters which have been used since 1946, and it may buy Fokker F.27 freightships to replace its DC-3 short-haul cargo aircraft.

The first DC-6A was delivered this summer and last month won the transport handicap section of the London-New Zealand international air race (a KLM DC-3 won this section of the similar London-Melbourne race in 1934). Delivery of the second aircraft will enable the Dutch airline to operate DC-6A's exclusively on its trans-Atlantic all-cargo route and also to introduce the high-speed freighters on services to South Africa and the Far East.

One of the reasons that KLM needs fast aircraft like the DC-6A is that to defeat prohibitions on fifth freedom traffic most of KLM's cargo has to be carried over long, indirect routes.

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CONGO 'COPTER—Health authorities of the Belgian Congo have won a battle against dread disease-carrying insects. Sikorsky S-51 helicopters spray insecticides on vast breeding areas inaccessible to other aircraft or spray equipment. Leopoldville residents are reported now to be as safe from carrier insects as are New Yorkers.

AROUND THE WORLD WITH SIKORSKY HELICOPTERS

"DRY RUN" RESCUE—Here a Navy HO3S Sikorsky helicopter awaits the loading of a "wounded" man carried on a stretcher improvised of poles and Navy jackets. This pickup was part of a practice operation for search and rescue helicopters and survival parties. The HO3S Sikorsky is specially equipped to carry litter patients.

UNUSUAL CARGO—This crashed Army L-19 liaison plane was salvaged with ease in Korea by an Army Sikorsky H-19 helicopter. Two trips were needed to fly the damaged wings, engine and fuselage (above, in cargo sling) to a repair depot. Army Sikorsky helicopters are now solving hundreds of tough, unusual transportation problems.

SPECIAL AIRLIFT—A wounded veteran, after months in a North Korean PW camp, is carried from an Army Sikorsky H-19 helicopter to a South Korean hospital in Seoul. As in earlier prisoner exchange activities, Army Sikorsky helicopters played a big part in the post-truce prisoner exchange, providing airlift for repatriated soldiers and other personnel.

SIKORSKY AIRCRAFT

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York to Rome has to pass through Amsterdam, since KLM is not allowed to fly direct between the U.S. and Italy. Whereas some passengers object to traveling an indirect route between two points, freight shippers do not mind, particularly if the indirect route is as fast or faster. KLM has therefore made special efforts to move its freight fast both in the air and on the ground.

An example of the way KLM speeds freight on the ground is the airline's special "Expediter Service" at New York, whereby shippers from all points in the U.S. can have their shipments placed aboard KLM aircraft at Idlewild without unnecessary delay. This notably involves a KLM truck calling daily at each domestic carrier's terminal at La Guardia to pick up cargo destined for overseas points via KLM.

At Amsterdam's Schiphol airport KLM has one of the world's largest freight buildings specially designed to handle the volume of transit cargo that passes through the Dutch airport. The $450,000 building features full refrigeration facilities for perishable goods as well as a "hotel" for animals.

Built into the structure are streamlined methods worked out by KLM to expedite handling. Outbound freight is delivered to the building at a truck-bed level platform. Here it is weighed, labelled, checked by customs, and sorted on pallets according to destination. Aircraft are parked on the apron in front of the building where the freight is delivered to them on German-built electric fork-lift trucks. The process is reversed for inbound freight.

To facilitate coordination of customs and forwarding documents with appropriate freight, personnel are equipped with a system of interphones. Close liaison is also maintained through use of an instrument built to KLM's specifications, which records data supplied by different departments. Through this nerve center, the operator maintains contact with personnel at work loading aircraft and with a special freight truck equipped with a walkie-talkie, which coordinates operations on the apron.

Using the most modern equipment on the ground and in the air KLM has established itself as a leader in the air freight field. Last year the company's freight business was worth just under one million dollars and there is every indication that the new freight rates coming into effect and the new equipment coming into service will greatly increase volume: to quote KLM's words of cautious optimism in discussing the future of air freight, "We are well placed to meet the competition." • • •

West Coast Talk

By Fred S. Hunter

A few notes on the recent speed runs, which brought great joy and elation to Douglas as a result of the two world records set by the Navy F4D, and a proportionate amount of disappointment to North American because the Air Force YF-100 couldn't quite tip them over:

A Navy pilot, Lt. Comdr. Jimmy Verdin, knocked off the big one—the world speed record of 753.4 mph over the three-kilometer course at the Salton Sea—but it was one of Douglas's own, Test Pilot Bob Rahn, who clipped off the 720.110 mph closed circuit mark over the 100-kilometer course at Edwards Air Force Base.

The Navy triumph surprised almost everyone—except the folks at Douglas, who were serenely confident the F4D had the performance to re-capture the record from the British. Those who were skeptical of the F4D were mainly so because of doubts about the Westinghouse J40 engine. It is to be replaced in production models by P & W's J57. A natural conclusion was that an airplane having the more powerful J57 would have a better chance. But the afterburner-equipped J40 fired up 11,000 pounds of thrust just as neat as you please, pushing the delta-wing F4D over Southern California's strange inland sea as fast as a J57 installation might have under the same conditions.

Truth of the matter is both Douglas and North American knew they could beat the British record and it was just a question of which airplane would get the first crack at it. Both the F4D and the YF-100 are capable of supersonic speeds at altitude, but not at sea level, where records have to be achieved to receive FAI recognition. In its record run, the F4D flew at a Mach speed of 0.96. That's getting up toward the transonic range. To surpass the F4D's mark by one per cent, the required FAI margin, Lt. Col. Pete Everest, the crack Air Force Flight Test Center test pilot, would have had to reach a considerably higher Mach speed, or have been lucky enough to catch a substantially hotter day. He wasn't lucky.

It's taken for granted that North American ultimately will beat the F4D record with the YF-100, or perhaps a production F-100. But if it has to wait for summer for favorable temperatures, there will be other competition. Convair's F-102, Lockheed's F-104, and Douglas El Segundo's A4D are all possibilities. It also is understood the British have definitely decided to ship a Hawker Hunter to the Salton Sea course. There have been times when temperatures have climbed fairly high in the Southern California desert during the winter season. If that should happen one of these days, watch North American jump.

To show how things work out sometimes, it's doubtful if Douglas would have achieved the 753.4 mph speedmark had it not been for the cooperation of its bitter rival. Douglas planned to make its bid for the record at Edwards. But when winds whipped up sand eddies obscuring the course, Douglas quickly accepted North American's invitation to use its facilities and hot-footed it to the Salton Sea forthwith. The below-sea level course at the inland sea belongs to North American, which installed it last year for Capt. Slade Nash's F-86D record. Moreover, North American's technicians at the site pitched in and gave the Douglas crew all possible help in their successful run for the record.

Cashing in on the speed runs in a big way is the Aero Club of Southern California. Members **Bert Rhine, Clyde Barnett, Dave Callahan, Andy Neff, Fred Stiefler, Bob Hanna, Bob Ringle, Jerry Collins** and **Bob Smith,** all assigned their FAI timer fees to the club. This, incidentally, is genuine magnanimity. Chasing off to the desert day after day is no picnic.

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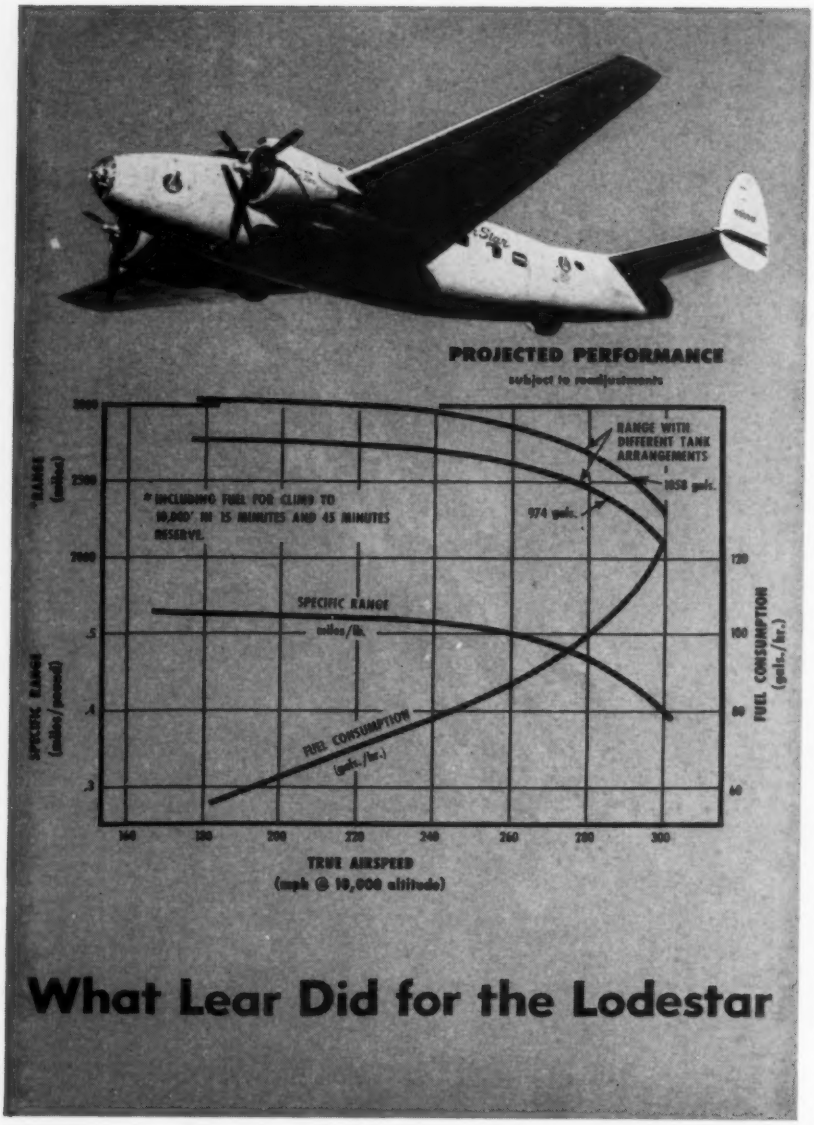

What Lear Did for the Lodestar

By Fred S. Hunter

BILL LEAR'S speed conversion of the Lockheed Lodestar may very well set a new pace for executive aircraft.

The "Learstar," which may or may not be the final selection for a name, will carry a performance guarantee of 270 mph true air speed at 10,000 feet at a power setting of 740 hp for each of its two Wright R-1820 engines. This means, of course, it will fly somewhat faster than its predecessor. Range with regular Lodestar tank installation for 644 gallons will be 1800 miles, but it can be increased to 3000 miles by the addition of two 220-gallon tanks in the outer wing panels.

Business flyers and other operators of executive aircraft, seeking faster wings, have heretofore had to turn to planes like the Douglas B-26 bomber. With a cruising speed near 300 mph, a B-26 conversion makes a fast executive, but having been a bomber it is cramped for cabin space, which limits its utility.

Lear, Inc.'s newly formed Aircraft Service Division at Santa Monica, Calif., expects to have the final configuration of the prototype Learstar completed by November 30. Meanwhile work has started on the first production model, which is being built under contract for Paul Butler, president of Butler Aviation. It will be finished shortly after the first of the year.

Lear has six Lodestars on the line at Santa Monica, one being the company's own executive aircraft which is serving in the dual role of flight test vehicle and prototype. Four planes are being used in working out the extensive modification program. One is being used as a reference plane, one as a load test plane, one as a mock-up plane, and the fourth as the flight test ship.

A subsidiary company, Learcraft Conversions, Inc., has been formed to market the craft, and orders will be taken for delivery next year. Price of a standard modification complete, including aircraft, is tentatively set at $225,000, with exact prices fluctuating according to type of power plant, interior cabin configuration, and other equipment variables.

The Lear program does not contemplate cabin pressurization at this time for the reason that it would boost the cost up toward the Convair 340 price bracket. If a buyer willing to pay the price shows up, however, it can be done, and Lear's plans include engineering explorations of how best to do it in view of the difficulties imposed by the configuration of the Lodestar fuselage.

Lear's modification of the Lockheed Lodestar represents a thorough engineering job and is particularly noteworthy for a project of this character. The airplane is being cleaned up not only for better performance, but for more comfort and luxury, and for easier maintenance.

It all started when William P. Lear, chairman of the board of Lear, Inc., and the company's director of research and development, happened to observe the difference in frontal areas of the Douglas DC-3 and the Lockheed Lodestar and got to wondering if a cleanup job on the Lodestar might produce a more efficient airplane, just as Douglas had made a more efficient Super DC-3 out of the DC-3.

Before he got through exploring all the possibilities, Lear, Inc., had an Aircraft Service Division and an engineering staff of 15, headed by Gordon Israel, former assistant chief engineer in charge of experimental design at Grumman Aircraft Engineering Corp., doing a complete engineering job on the twin-engine transport. Instead of the four or five mph increase in speed that Lear originally was advised he might attain by cleaning up the Lodestar, the "Learstar" has picked up 60 mph or more.

Lear is measuring its performance gains by applying the precise flight research method developed for sailplanes by Dr. August Raspet, director of the aerophysics department of Mississippi State College. This is the first time this method has been used on a powered craft.

Glide measurements are made by Ed Swearingen, research pilot for Lear, Inc., by taking the flight test Lodestar up to 20,000 feet, shutting off the en-

Nineteen hundred and fifty-three marks man's first half-century of powered, heavier-than-air flight. Fifty years ago, on December 17, 1903 the Wright Brothers successfully built and flew a 12 horsepower biplane. For 12 historic seconds Orville Wright took the controls over Kitty Hawk.

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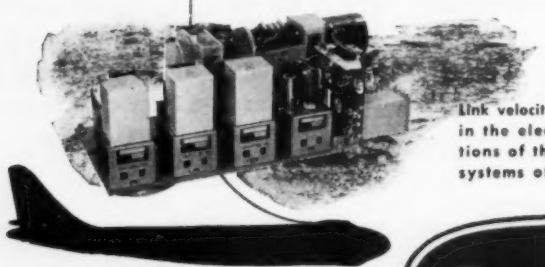

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gines, feathering both propellers, and measuring the sinking speed at various forward speeds. The engines are brought back in at 10,000 feet, after which a climb to 20,000 feet is again made and the measurements repeated.

From these glide tests, the thrust horsepower required for the airplane with engine cowl open and closed is determined. By using torque meters in the engines on succeeding flights, the brake horsepower is measured. From the thrust horsepower in the glide and the brake horsepower, the overall propulsive efficiency is determined as well as the true drag coefficient.

The figures from Swearingen's test flights are sent to Dr. Raspet at Mississippi State for analysis in terms of what can be expected from boundary layer theory and to deduce power losses. Dr. Raspet makes a diagnosis of the airplane configuration and applies corrections in regions where separated flows exist, as shown by tuft photos or by extending the laminar flow using geometric boundary layer control. Subsequent measurements after modification of the airplane confirm or contradict the validity of the diagnosis as well as supply data for diagnosing second order effects.

Nacelle Changes

Most important design changes in the speed conversion center around the nacelle area. The nacelles are entirely new, including a jet stack exhaust system (which replaces the collector rings), new cowl flaps, new carburetor air intake, new engine mounts, and doors to enclose the main wheel wells. As an illustration of how Lear's attack on interference drag is paying off, tests demonstrated an increase of 12 mph in flying the Lodestar with the wheel well doors closed.

A special accomplishment of the new nacelle design makes it possible to shift the position of the engine three inches farther outboard. This in turn takes the propeller tips the same distance farther away from the fuselage, making the separation five inches instead of two. This change removes the pulse beat of the propeller tips against the fuselage as a source of vibration.

Application of the augmenter principle to the exhaust system along with the cowl flaps netted sharp improvement in cooling characteristics. The jet stacks, siamesing into three exhaust tubes, each one serving three cylinders, also are in accordance with Wright Aeronautical's research on such installations as a means of eliminating back pressures; they help cut weight of the exhaust system in half.

Ram air duct for carburetor air is

incorporated in the cowling. It provides 1.6 times as much air as the old intake scoop while creating less drag. An abrupt change in direction within the cowling removes most of the water and other foreign matter that may be present in the free outside air.

Bill Lear is a believer in the theory that simpler maintenance makes for safety. If a spark plug is easy to change, it's changed. If it's difficult to change, the tendency will be to let it go until there are other reasons to remove the cowling.

As a result the new nacelle was blueprinted so that it can be un-cowled and re-cowled within five minutes. The entire ring cowl is removable by releasing four over-center toggle latches. A carburetor change takes only one fifth the time it took with the original Lodestar.

Weight of the engine mount is less than before, despite the fact that it is designed for greater loads and involves shock absorbers four or five times larger. Vibration has been reduced by connecting the exhaust system to the engine and disconnecting it from the airframe. Lear engineers say the new mounts will give 1200 hours of service as compared with 300 hours for the old.

Aerodynamic modernizations are as frequent as they apparently are effective in boosting the Lodestar's performance aloft. Gone are the "bat wings" and the external flap tracks, Lear having found that 5% flaps on take-off will give everything the "bat wings" did, and that pilots almost never used more than 50% of flaps in landing.

A major wing modification is the application of a tapered "droop-snoot" to the airfoil to increase the camber out to the tip for the dual purpose of increasing lift and preventing wing tip stalling.

Increasing the length of the chord of wing and flap to make a feathered trailing edge was the basis of another major wing improvement which increased the airplane's speed four mph and at the same time added four square feet of wing area and three square feet of flap area. Sealing off the leading edge of the flap up into the wing brought an additional four mph. A third four-mph increase was obtained by changing the angle of attack of the horizontal stabilizer and reducing the trail of the elevators without adversely affecting the controls.

A neat six mph was picked up by eliminating tail wheel drag. Retracting the tail wheel required the design of a complete new aft bulkhead and a track for the tail wheel strut. Lear actuators close the tail wheel doors, which are interlocked with the main gear latch and selector lever.

A new tear-drop-shaped windshield was developed for a number of reasons. In the first place, the streamlining will net two to five mph. Second it will provide better visibility. A pilot will have to lean forward only four inches for full visibility straight up and 90° to the right or left. This, Lear engineers say, is a 100% improvement in the cone of visibility. A third reason for the new-type canopy was a reduction in ultrasonic frequency noises which tests indicated were penetrating the cockpit.

Being a pilot, Bill Lear overlooked no opportunities to fix up the cockpit itself. All gear was removed from the floor and overhead. A new-style pedestal was designed for more efficient operation of controls and, incidentally, provide plenty of clearance for crew members. The front spar has been lowered to even off the floor.

Antenna masts, pitot tubes, dump valves, door handles, all relatively unimportant in consideration of interference drag before, took on new significance in Lear's clean-up job. Even windows are individually fitted and shaped to smooth out the air at the window line.

Interior configuration incorporates a variety of refinements designed to make the Lodestar a more attractive executive craft. Soundproofing incorporates the new technique of cementing aluminum foil to the skin of the fuselage and is further insulated by three septums of glass and vinolite. Standard interior has two couches forward and four seats aft. The divans combined with two chairs make up into four

Congregation of Constellations. Eighteen military Super Connies are visible in view of Lockheed installation at Burbank, Calif. Some are USAF RC-121C's being fitted with radomes; others are R7V-1's for delivery to Navy and MATS.

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Lear's new Aircraft Service Division occupies a hangar at the Santa Monica Municipal Airport and currently has a payroll of 150. It expects to increase this to 250-275 in the next few weeks. Arthur W. Cruse, formerly vice president of L.B.S. Aircraft Corp. in Miami, is general manager of the new division, which is planned as a one-stop service facility for all types of business and executive aircraft as well as for speed conversions of the Lodestar.

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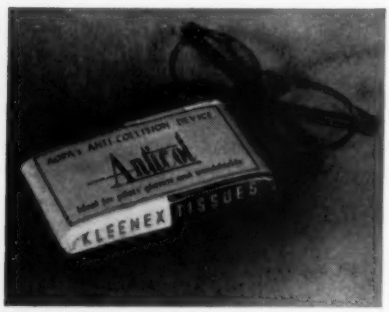

New look at air safety — through cleaner glasses and windshields—is being advocated by the Aircraft Owners and Pilots Association. To make its viewpoint clear, and mid-air collisions rarer, AOPA is distributing small packs of Kleenex in wrappings that identify them as "Anticol . . . Ideal for pilots' glasses and windshields."

International Freight Rates May be Cut

Airfreight rates, due for a 25% increase in CAB imposed minimums for domestic hauls, appear to be headed downward for international shipments.

Pan American World Airways has filed for decreases (as much as 45% for large shipments) effective November 16, for trans-Atlantic traffic. Other IATA carriers have indicated reductions are in order, but favor a continuation of the specific commodity rate approach.

IATA Traffic Conference meetings in Honolulu will have the rate reduction problems to solve, since present IATA agreements covering airfreight rates expire November 15.

Extra Section

By Lois C. Philmus

OF THE ENTIRE INDUSTRY, the airport segment is probably going through the period of greatest transition under the new administration. Federal aid-less days have called for a complete re-evaluation of airport development plans. There is a growing restlessness among some airports, and a desire to shake off the shackles of surplus property deeds. A set pattern of equitable airport user charges is being fought for as a means of putting the fields on a self supporting basis. Briefly, here's how things stand now:

•

FEDERAL AID: Two re-evaluation studies are currently under way, and supposedly Federal aid's future will be decided on the basis of the two reports which will go to Under Secretary of Commerce Robert B. Murray. One is being compiled by an industry study committee; the other is a CAA evaluation. The ultimate outcome? Anybody's guess. We'll take a flier (based on current odds) that there will be Federal airport money in fiscal 1955. But it won't be easy money. Criteria will be based on traffic volume, public convenience, and necessity. No allocations will be made for such structures as terminal buildings and hangars. Rather, allocations will be made for runways, taxiways, and lighting. Commerce has stated it will continue Federally operated control towers, but money will be for operation only, not for new structures.

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The aid-less fiscal 1954 days have actually had a very stabilizing effect. After the cries of pain from the sudden cut-off died out, airport people licked their wounds and began to heal. When your extra money is cut off, you suddenly find out just what you can do without and still get along nicely. The airport officials started economizing. In so doing, they found that they could do with a $500,000 terminal building instead of that million dollar one. Perhaps they didn't need that runway extension right away, and so forth. Where the cut really hurt, and probably continues to hurt, is in such areas as Harding Field in Baton Rouge. Emergency aid was sought for much needed runway repairs—without which the field has been in danger of having to close down.

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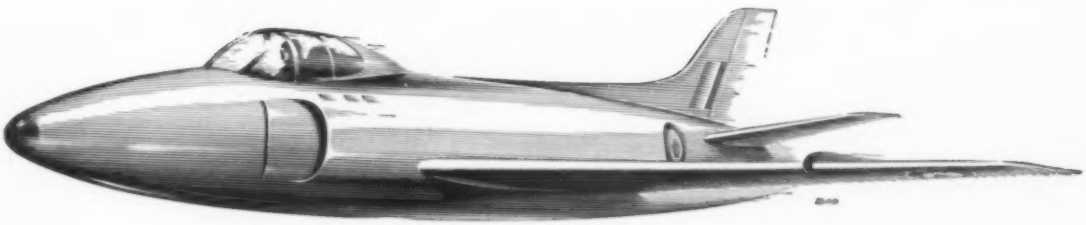
AIRPORT USER CHARGES: The municipal officials are pressuring airport managers to move over onto the black side of the ledger. Actually, more and more airports seem to be showing operating profits. But most feel the answer to profitable operation lies in establishment of more equitable user charges. Negotiations are on at many fields to boost airline landing fees and terminal rentals. Prevalent feeling at joint-use fields is that the military should be paying the same use fees as civil aviation. CAA Administrator Fred Lee's failure to go through with a definition of substantial use is being blamed on Defense Department influence. The airports, in lieu of a governmental definition, are drawing up their own. Look for a strong movement in the not too distant future to have the airport owners' definition enforced. The airlines are resisting any boost in their charges and from all evidence would like to see them remain as they are, or even lower. Naturally Frontier Airlines' application to by-pass Winslow, Ariz., is based solely on a user-charge controversy. AAAE is much concerned over the role CAB will play in this and has formally filed intercession papers.

•

SURPLUS PROPERTY DEEDS: Joseph D. Blatt, assistant CAA administrator for program planning, has been conducting a study of the various deeds. Some airports have as many as three of the approximately seven contracts in effect, causing overlapping, conflict, and duplication. Basis of the study will be to recommend legislation to remedy the situation.

In the meantime, though, airports are claiming that all Federal deeds are standing in the way of civil and industrial aviation development. Negotiations under way between Commerce and Louisville, Ky., are being watched carefully.



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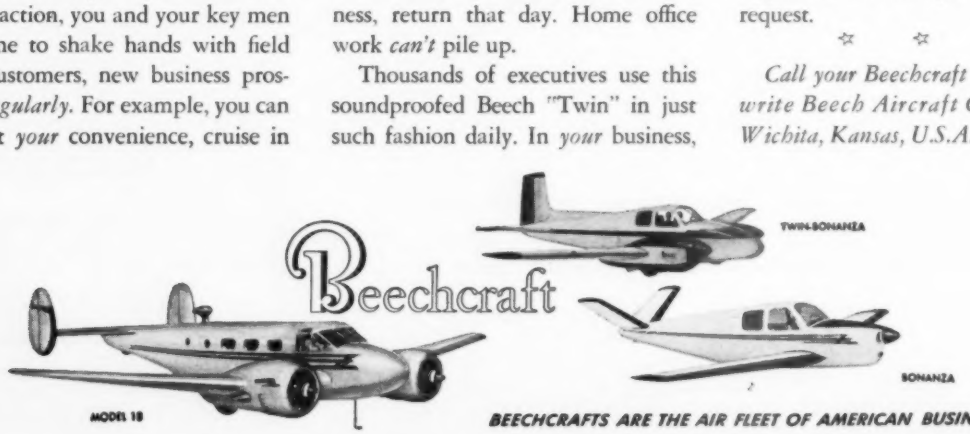

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The Viscount, first propeller-turbine airliner in the world, now in service with British European Airways and on order for Trans-Canada Air Lines, is designed and built by Vickers-Armstrongs in England. It is powered by four Rolls-Royce Dart engines.

The fact that this aircraft, designed for medium-range operation, was the first transport aircraft to reach Christchurch, New Zealand, is further testimony of its versatility and the reliability of the engines.

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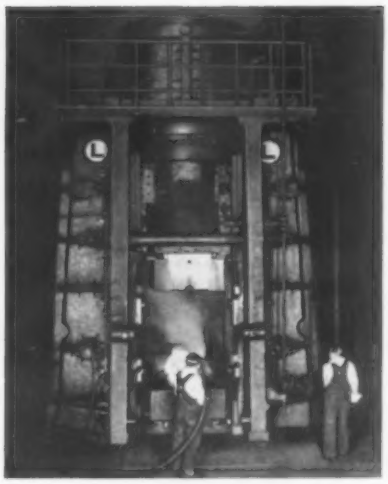
Canberras move down final assembly line through last assembly stages at the English Electric Co. plant at Warton Airfield, England.

Production Lines



One hundred inch propeller blade is largest titanium alloy die forging made today. USAF research project will use the big blade, which has been forged by the Ladish Co., of Cudahy, Wisc., using the most powerful closed impression die forging hammer in the world (right). High-strength titanium alloy, Ti-140-A, is used to increase strength and reduce weight.

External wing tank for the Boeing B-52 Stratofortress is shown above as manufactured by Rohr Aircraft Corp. at its Chula Vista, Calif., plant.

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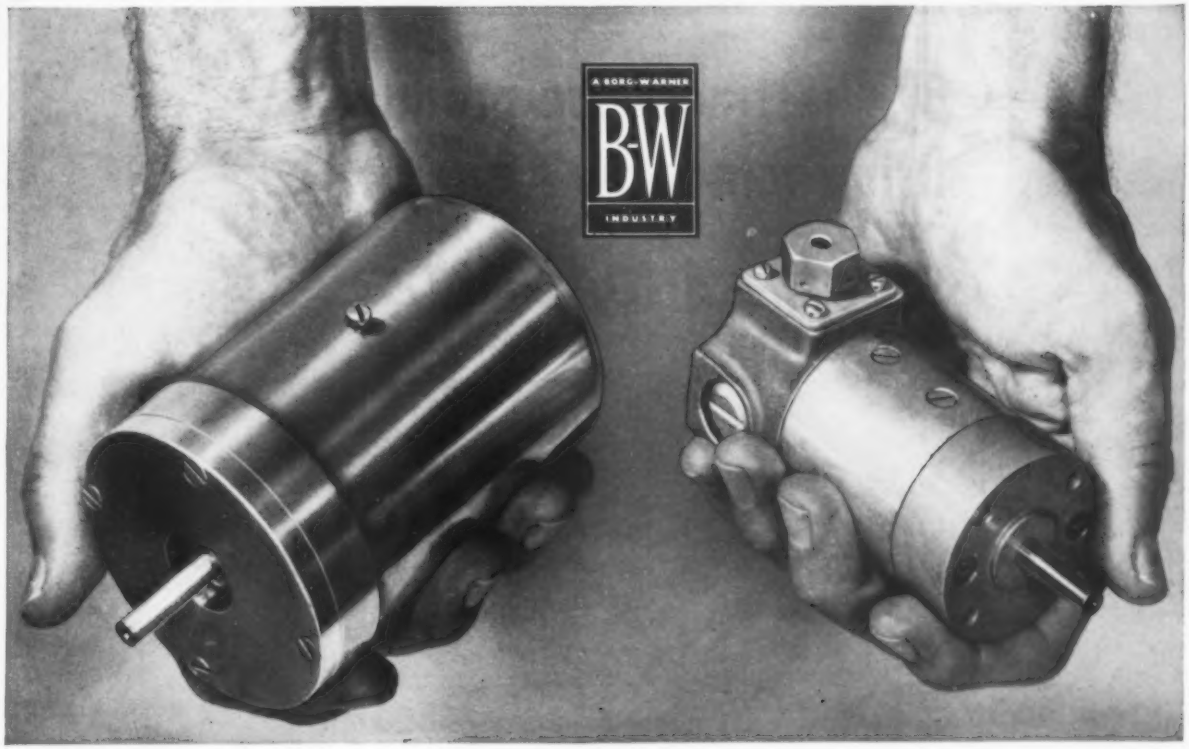

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87 Westinghouse products
bring tomorrow's aircraft
One step closer

DRAWING BY LEONARDO DA VINCI, "FLYING MACHINE WITH A MAN", COURTESY REYNAL AND HITCHCOK, HARCOURT BRACE AND COMPANY.

SCALE NACA MODEL, COURTESY LEWIS FLIGHT PROPULSION LABORATORY, CLEVELAND, OHIO

da Vinci's concept never envisioned the supersonic age . . . or the complexity of modern aircraft. But in this "Span of Flight", aviation designers have telescoped centuries of normal evolution into fifty short years of accelerated progress. 87 Westinghouse products have helped make this possible. Yes, it's true, between Magamps . . . turbojets . . . fire control radar . . . electrical systems . . . aircraft motors and Micarta® there are 87 different Westinghouse products helping the aviation industry bring tomorrow's aircraft—One Step Closer.

This scope of Westinghouse in aviation is important to you. Not only the particular advancements highlighted in this "One Step Closer" series, but any one of the 87 products can become a solution to your subsystem or component parts problem. Coming from the engineering and productive skills of twenty-three divisions, they are part of a continuing research and development program dedicated to improving the capability and potential of tomorrow's combat and commercial aircraft.

SEND FOR "SPAN OF FLIGHT"

This special photographic document was prepared to emphasize this Westinghouse ability and interest in helping you achieve the goal of tomorrow's aircraft. It exemplifies the "Span of Flight" from Leonardo da Vinci's 15th century "flying machine with a man" to a current NACA concept of tomorrow's aircraft. It is yours —in beautiful sepia, without copy and suitable for framing—for telling us just how many Westinghouse aviation products are known to you. Check them in the coupon below . . . your "Span of Flight" will soon be on its way. J-91012

YOU CAN BE SURE...IF IT'S

Westinghouse

WESTINGHOUSE ELECTRIC CORPORATION
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- ☐ Turbojet engines.
- ☐ Autopilots, radar and fire control systems.
- ☐ Communications equipment, air-borne and ground.
- ☐ Aircraft electrical systems, a-c and d-c.
- ☐ Air-borne instruments, transformers and rectifiers.
- ☐ Gyro-motors and temperature control panels.
- ☐ Generating equipment, circuit breakers, contactors.
- ☐ Aircraft motors, actuators and hoists.
- ☐ Electronic tubes and Magamps.
- ☐ Wind-tunnel drives and Micarta.
- ☐ Airport lighting and wind-indicating equipment.

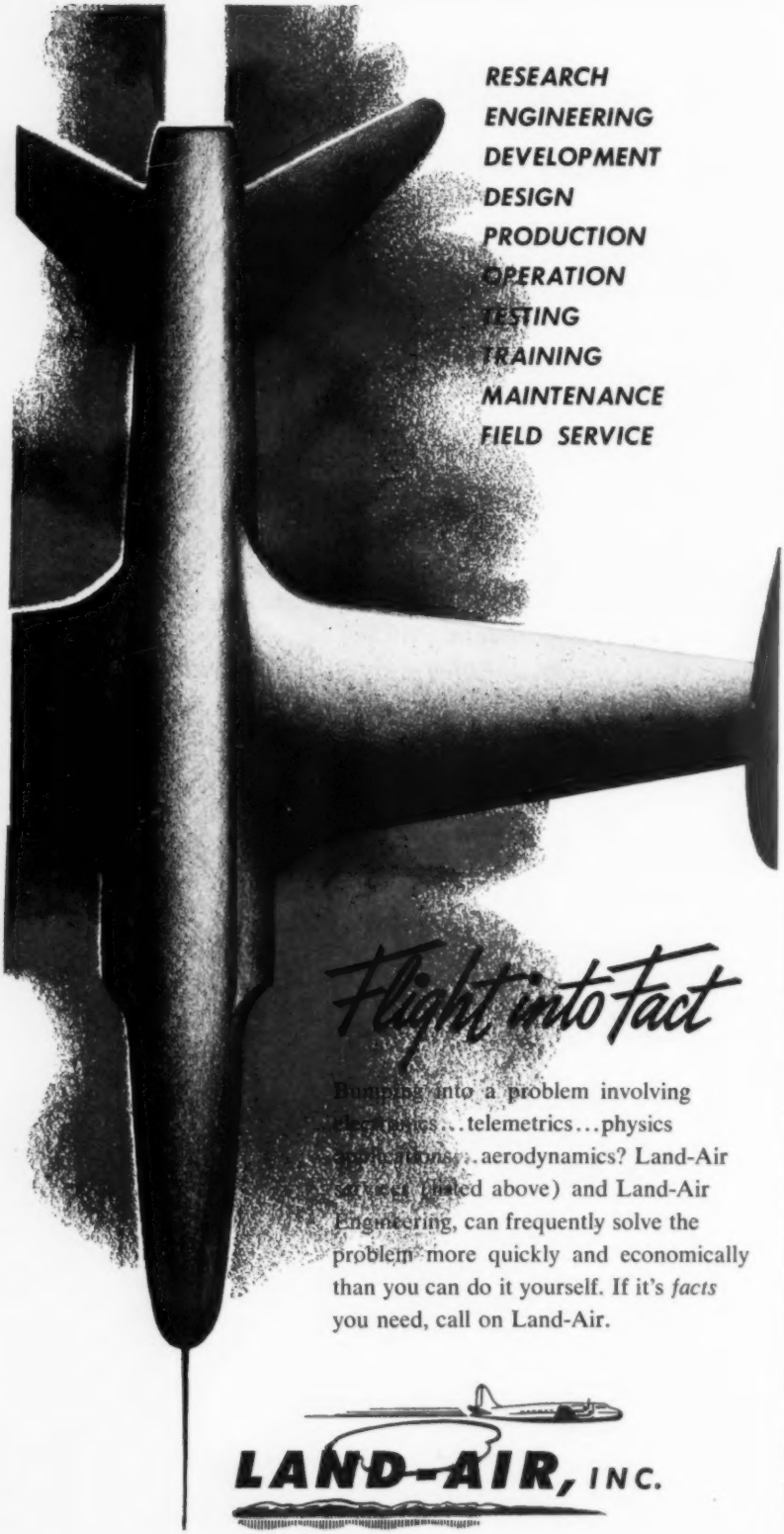
Please send me "Span of Flight", without copy and suitable for framing.

Name_____ Title_____

Company_____

Address_____

City & State_____



Letters

(Continued from page 6)

aircraft of which we have knowledge.

We are, therefore, very much interested in the acceptance by the CAA of the Curtiss under transport category standards, and naturally want to get as much gross as is economically possible. We have read what was available on the Flying Tiger's experience with the addition of a jet, and also the items concerning El-Al Israel's proposed two-jet addition on the underside of the C-46 fuselage. We have just recently obtained a price of $14,000 for the kit to convert the cowling and put on the fire warning and CO_2 systems.

Our company has two things to consider: First, the difference between the "A" and "F" Models with respect to gross load; second, obtaining or bettering the equivalent gross that the "F" has enjoyed in the past.

We will be very much interested in any other information that may be forthcoming on the C-46, and, of course, we would be especially interested in a comparative evaluation study between the different proposals for increasing the gross, that is re'ating the costs and performance of modified R 2800 to the -16; modification of the nacelle; addition of jets; and/or any other alternative proposals.

GEORGE B. RAYBURN
Executive Vice President
Wien Alaska Airlines, Inc.
Fairbanks, Alaska

•

MORE TALK

To the Editor:

Regarding the voluble Mr. Shannon as reported on page 53 of your August 17 issue, may I offer my opinion? Having been along when Ken Ebel first checked Sam on boats, I can assure you that Sam probably would have said, "Oh—Brother." Ken would have said "Gee, whiz, what a landing."

Incidentally, Sam really isn't much more voluble than Ken Ebel; ask Mac McCarty.

R. G. NIGHTINGALE
Chief Engineer
The Colson Corporation
Elyria, Ohio

•

STYLE AND THE NEWS

To the Editor:

Regarding the knuckle-rapping letter on page 6 of the October 12 issue of AMERICAN AVIATION: Meant to congratulate you earlier on the well-written Air Force manpower report turned in by Cy Caldwell, but it took Reader Brown's letter on the subject to overcome my inertia.

Apparently Brown is a student of the old school that subscribes to the notion that facts are facts and inevitably self-explanatory. Such is not always the case, in railroading or aviation, and Caldwell is to be congratulated for bringing at least one phase of the Wilson & Co. program into focus. He has related a news story in terms of the men whom it affects, and I wish I could have turned out a piece of copy to equal it.

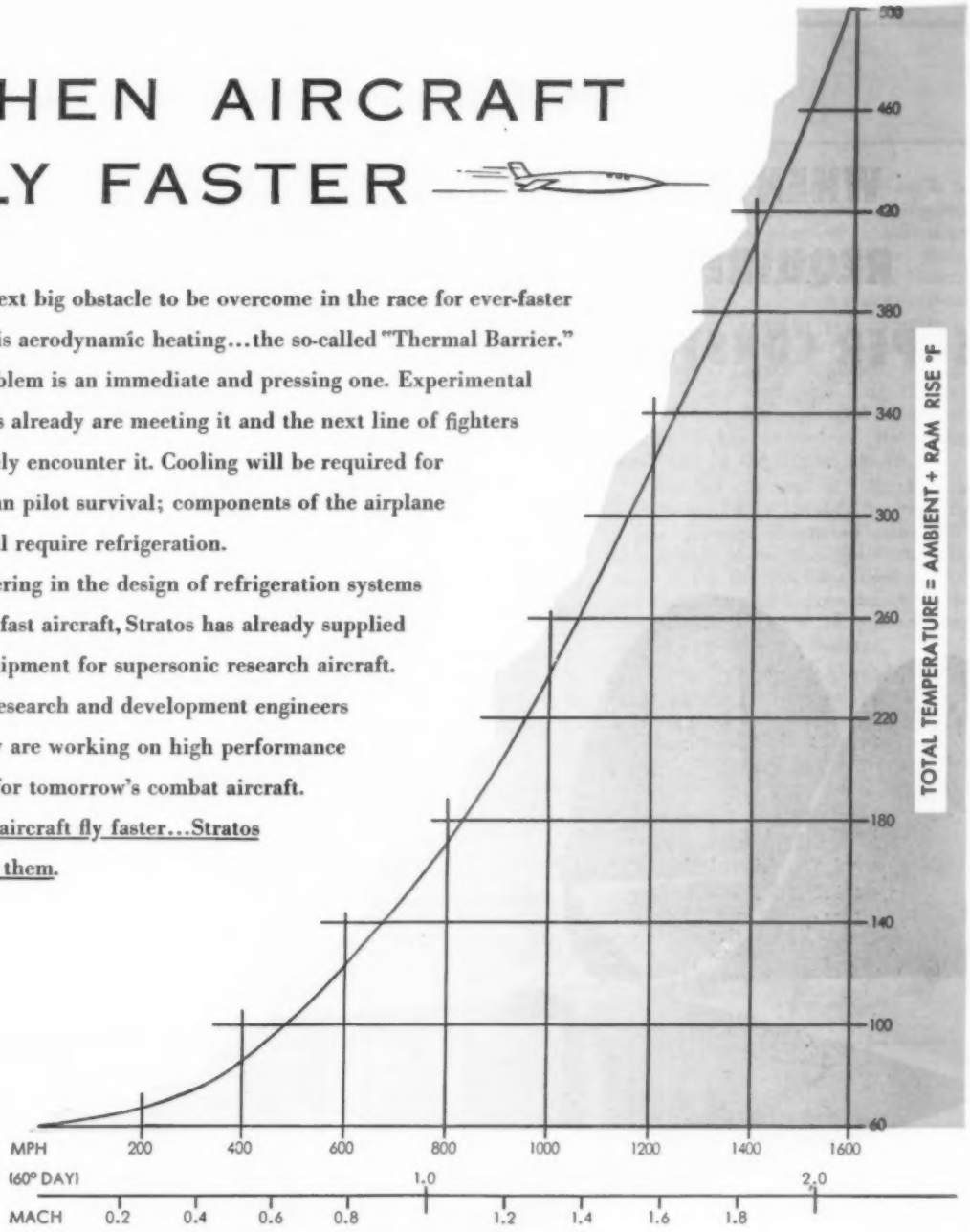
DAVID P. MORGAN
Editor, *Trains & Travel*
1027 N. Seventh Street
Milwaukee 3, Wisconsin

WHEN AIRCRAFT FLY FASTER

The next big obstacle to be overcome in the race for ever-faster aircraft is aerodynamic heating...the so-called "Thermal Barrier." The problem is an immediate and pressing one. Experimental airplanes already are meeting it and the next line of fighters will surely encounter it. Cooling will be required for more than pilot survival; components of the airplane itself will require refrigeration.

Pioneering in the design of refrigeration systems for very fast aircraft, Stratos has already supplied such equipment for supersonic research aircraft. Stratos research and development engineers currently are working on high performance systems for tomorrow's combat aircraft.

When aircraft fly faster...Stratos will cool them.



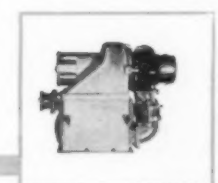
STRATOS

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORP.

Main Office and Plant: Bay Shore, L. I., N. Y. • West Coast Office: 1355 Westwood Blvd., Los Angeles 24, Calif.

TYPICAL STRATOS PRODUCTS

REFRIGERATION TURBINE FOR F-86 "SABREJET"



REFRIGERATION PACKAGE FOR B-47 "STRATOJET"

AIR-TURBINE DRIVE FOR OPERATING ACCESSORIES

BOOTSTRAP COOLING UNIT FOR TRANSPORT AIRCRAFT

CABIN SUPERCHARGER FOR TRANSPORT AIRCRAFT

WATER

WHEN AND WHERE REQUIRED FOR THE SUPER CONSTELLATION

PASSENGERS aboard Lockheed's luxurious Super Constellation naturally *expect* a dependable and ample supply of clean water. Thanks to Lear-Romec's efficient turbine water pumps, they get it. And along with these niceties for passengers, comes a break for maintenance personnel. Utilizing pressure feed instead of gravity, tanks are installed below the floorboard, making for simple servicing. The compact pump mounts vertically on the under side of the water tank, with all plumbing and electrical connections exposed for easy access.

The Lear-Romec pump illustrated is a submerged turbine-type water utility pump. It is one of a series available in AC and DC motor drive, originally developed for military aircraft, and produced by Lear-Romec for the past ten years. Weighs 2.8 pounds less than equivalent model vane-type pumps. Similar turbine type pumps are also furnished by Lear-Romec for aircraft engine water injection systems.

Bring your pump problems to Lear-Romec—*specialists* in aircraft fluid system components.

LEAR INC. LEAR-ROMEC DIVISION
ABBE ROAD, ELYRIA, OHIO
Executive Offices: 3171 S. Bundy Drive, Los Angeles 34, Calif.

LEAR-ROMEC MODEL RR-9700-A A fully submerged type turbine aircraft pump. Supplies wash water or anti-detonant solution. Nominal rating 110 gph at 35 psi discharge. Adjustable in range to 25 psi at 150 gph. This unit is 27 volt DC, 11 amps. continuous duty, and has integral radio noise filter on the motor. Weight 5.68 lbs.

RO-4

Maintenance Bulletin Board

Capitol Tests Anti-Collision Light

In a program aimed at determining the operating characteristics of various types of anti-collision beacons, Capital Airlines' engineering department under Land Caldwell is now service testing a new beacon light manufactured by Federal Enterprises Inc. of Chicago, Ill. Capital is also planning to evaluate a new unit being developed by the Ace Foundry Co. of Chicago.

The new Federal beacon (see photo) weighs only three pounds, 2/3 as much as the Grimes unit adopted by both American Airlines and United and now is being installed on their combined 300-airplane fleets. Similar to the Grimes light, the Federal unit rotates at 40 rpm, but uses a glass lens instead of the red plastic dome on the Grimes unit.

Capital's goal in the program is to find a beacon with the best performance from the standpoint of maintenance and which will provide collision warning over a wider area. Both the Federal light and the unit under development by the Ace Company give promise of improved maintenance characteristics, according to Capital engineers, through use of a low heat generating 100-watt light bulb of the type used in aircraft landing lights, instead of the sealed beam unit in the Grimes beacon.

Another feature of the Federal light favored by Capital is the warning it provides over almost the entire 180° hemisphere above the horizontal. Instead of the fin mounting used by AA and UAL, Capital is considering use of two beacons, one on the top and one on the bottom of the fuselage.

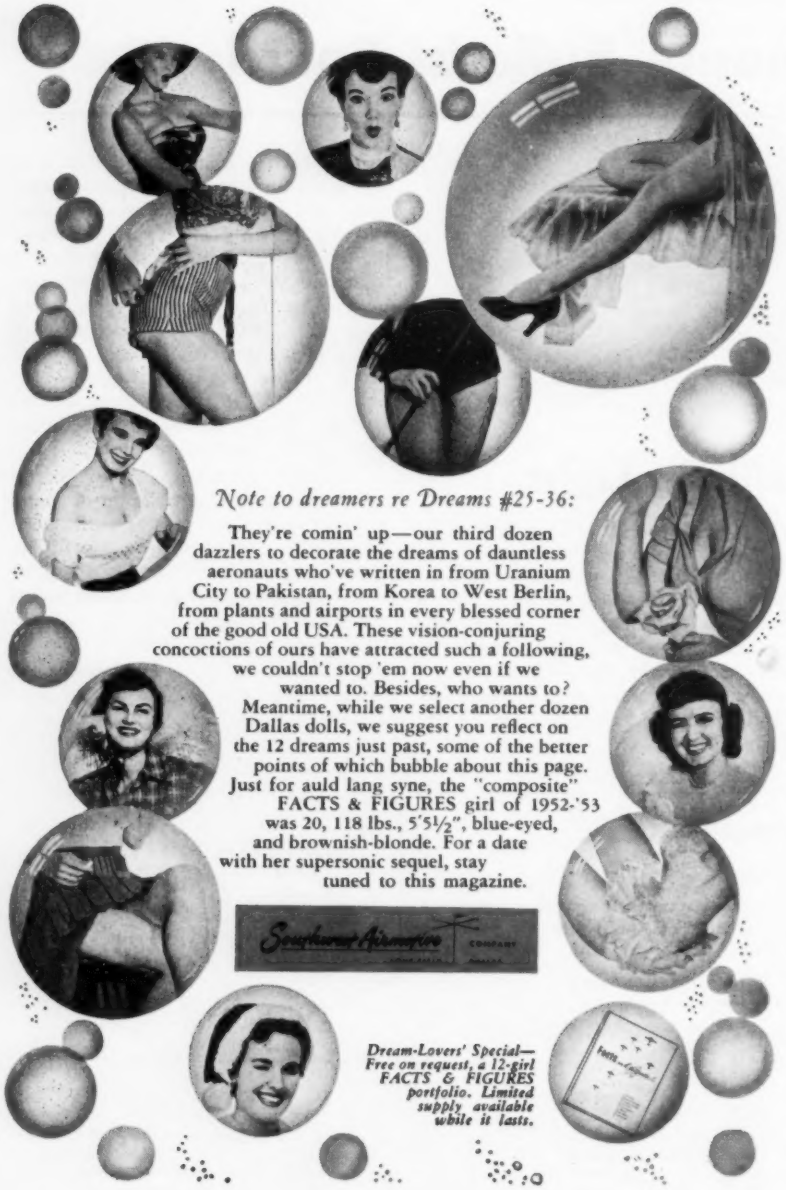
The new testing at Capital involves installation of the Federal beacon on a Douglas DC-4. The only service complaint to date has been one typical of Capital's experience with other lights tested, that of reflections on the wing

Convair 240 Operating Costs

Western Air Lines

	Cents Per Total Mile					
	Oct.-Dec. Year 1948	Year 1949	Year 1950	Year 1951	Year 1952	Six Months 1953
Flying Operations:						
Pilot and co-pilot pay	10.58	10.74	10.18	11.82	13.26	13.45
Training pay	(0.08)	0.10	....	....	0.09	0.81
Travel and incidental	0.96	0.96	1.10	1.26	1.28	1.37
Aircraft fuel and oil	14.40	13.62	14.64	15.17	16.51	19.15
Insurance	11.02	6.67	5.01	4.52	3.63	4.18
All other	5.02	1.44	2.35	1.62	2.10	2.68
TOTAL	41.90	33.53	33.28	34.39	36.87	41.64
Direct Maintenance						
Engine overhaul:						
Labor			0.97	0.91	0.98	1.16
Materials			2.41	3.69	5.83	7.61
Subtotal	N.A.	N.A.	3.38	4.60	6.81	8.77
Other direct						
Labor			3.60	3.73	6.40	7.80
Materials			5.34	5.12	5.50	8.13
Subtotal	N.A.	N.A.	8.94	8.85	11.90	15.93
TOTAL	12.96	12.39	12.32	13.45	18.71	24.70
Indirect Maintenance (All types—See note)						
Labor	6.71	6.38	5.87	7.10	6.14	5.58
Materials and other	1.86	1.49	1.39	1.61	1.65	1.97
TOTAL	8.57	7.87	7.26	8.71	7.79	7.55

Note: Indirect maintenance cost per mile is computed on total maintenance division indirect expense (without regard to CAB classification) for *all types* of equipment. No allocation to CV 240's available.


Note to dreamers re Dreams #25-36:
They're comin' up—our third dozen dazzlers to decorate the dreams of dauntless aeronauts who've written in from Uranium City to Pakistan, from Korea to West Berlin, from plants and airports in every blessed corner of the good old USA. These vision-conjuring concoctions of ours have attracted such a following, we couldn't stop 'em now even if we wanted to. Besides, who wants to? Meantime, while we select another dozen Dallas dolls, we suggest you reflect on the 12 dreams just past, some of the better points of which bubble about this page. Just for auld lang syne, the "composite" FACTS & FIGURES girl of 1952-'53 was 20, 118 lbs., 5'5½", blue-eyed, and brownish-blonde. For a date with her supersonic sequel, stay tuned to this magazine.
Dream-Lovers' Special—Free on request, a 12-girl FACTS & FIGURES portfolio. Limited supply available while it lasts.

WORLD'S PREMIER AIRPLANE FABRIC

lighter — stronger — smoother

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Leading Manufacturers of Fabric and Tapes for the Aircraft industry.

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Export Representative AVIQUIPO, Inc. 25 Beaver Street, N. Y. Cable: Aviquipo

tips under cloud or haze conditions, giving the illusion of an engine fire.

Other tests by Capital have included mounting of the Grimes light on a DC-4 and installation of an earlier design unit manufactured by Ace Foundry Co. on a Lockheed Constellation.

New KLM Galley Wins Acceptance

A new aircraft galley design for Lockheed Super Constellations, developed and built in Holland for KLM Royal Dutch Airlines, is being adopted by many other airlines according to Lockheed Aircraft Corp. officials. The Dutch-designed food and liquor service installation occupies only 56 square feet of cabin area, but can turn out more than 135 full course meals during a single trans-Atlantic flight.

Main compartments of the KLM galley:

- **Service bar** stores 75 service trays, liquor supplies, and beverage glasses. Located on forward left hand side of galley compartment, it includes complete bar and liquor dispensing equipment, a concealed sink with ball-socket spigot, and hot water supply.
- **Hot section** on forward right side contains a two-unit oven with plug-in connections for two large hot liquid containers. An upper section has tiered shelves for cutlery and utensil storage as well as compartments for liquid storage.
- **Cold section** on aft right side features a 10.8-cubic-foot capacity electric refrigerator and two-compartment deep-freeze cabinet.
- **Sideboard** located against right fuselage wall provides a four-gallon deep well and recessed compartments for waste receptacles.

MAINTENANCE BRIEFS

A suggestion to extend the service life of Pratt & Whitney R-2800 engine master rods recently brought a $50 award to John J. Rush, American Airlines inspector. Rush proposed that by reversing the position of the master rod at each overhaul, wear on the #12 and #13 link pin holes, which is usually greater than on holes #4 and #5, would be distributed to the latter pair after alternate overhauls.

•

Revised B. F. Goodrich retreading process is under test by American Airlines on Convair 240 size 34 x 9.9 "dimpled" tires. Recent retread failures had led AA to halt use of Goodrich second and third retreads on this tire.

serving the U.S. Navy...

Marquette **WINDSHIELD WIPERS**

Lockheed P2V Patrol Bomber equipped with Marquette Wipers

The Marquette
METAL PRODUCTS CO.
CLEVELAND 10, OHIO
SUBSIDIARY OF CURTISS-WRIGHT CORPORATION

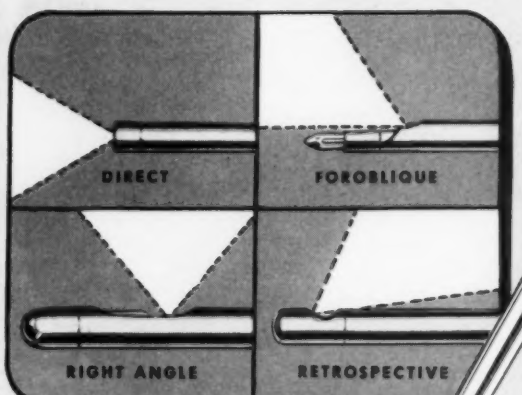
Also Manufacturers of:
ROLLER BEARING TEXTILE SPINDLES
WINDSHIELD WIPERS FOR AIRCRAFT
FUEL OIL PUMPS AND INJECTORS
PRECISION PARTS AND ASSEMBLIES
ROTARY HIGH PRESSURE OIL FIELD PUMPING MACHINERY

INSPECTION OF CONFINED AREAS FACILITATED

NECESSITY OF DISMANTLING AVOIDED

TIME SAVED—MONEY SAVED

A.C.M.I. BORESCOPES



A.C.M.I. Borescopes are available in 4 angles of vision (as above)— in diameters of .120" to 4.00"— in lengths of 4" to 720". Special models for special problems.

The A.C.M.I. Borescopes permit close-up visual examination of interior areas and surfaces not otherwise visible. They save time and money, and prevent costly dismantling, by providing a practical solution to a wide variety of inspection problems.

In maintenance and inspection work, on small internal bores, machine parts or castings, to large boiler tubes, chemical plants, process equipment, or other industrial installations, an A.C.M.I. Borescope may be the answer to *your* problem.

Each Borescope is a compact, self-illuminated industrial telescope of highest quality, employing a precision optical system, that produces a flat visual field. Lens systems are fully corrected for color, spherical aberrations, and coma, with all lens surfaces coated to increase light transmission.

Write for free informational folder, or tell us your problem.

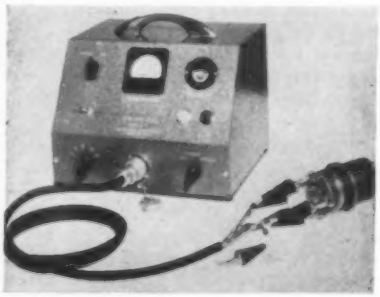
American Cystoscope Makers, Inc.

1241 LAFAYETTE AVENUE **NEW YORK 59, N. Y.**

New Products

Deburring Tool. An automatic deburring tool which can be used in a portable drill motor, a stationary drill press, or turret lathe for deburring and chamfering the front and back faces of holes in sheet metal, extrusions, castings, or forgings is being produced by the Nobur Manufacturing Co. Called the Noburmatic, the new device deburs the front face of the metal upon entry into the hole, while the rear side is deburred during the withdrawal cycle. Two types are available, a model GCN, for non-ferrous metals and other soft materials, and a model GCF, for ferrous metals and tough working materials.

Address: **Nobur Manufacturing Co.,** 717 North Victory Blvd., Burbank, Calif.



Synchro Null. A calibration device for accurate zeroing of synchros of all types, called the Synchro Null Model 101, will more than halve the time for the manual adjustment, according to its manufacturer, the Ultrasonic Corp. A simple switching operation automatically selects the proper test circuit connections for each type of synchro, and the proper sequence of test circuits for the null operation.

The model U-101 is adaptable to 26 volt-400 cycle synchros as well as 110 volt-60 cycle and 110 volt-400 cycle units of all standard types and sizes. Unit is said to be capable of clearly detecting a variation of ten millivolts, corresponding to 0.6 minutes of angular adjustment error.

Address: **Ultrasonic Corps.,** 61 Rogers St., Cambridge 42, Mass.

Fluted Cutter. A multi-fluted cutter for producing standard AND-10050 ports or connecting holes for hydraulic valves and fittings has been announced by Sonnet Tool & Mfg. Co. Using a four-fluted design, with each flute performing a special operation to produce the port contour, the new Sonnet tool features a carbide tip for long-life service.

Address: **Sonnet Tool & Mfg. Co.,** 576 No. Prairie Ave., Hawthorne, Calif.

New Passenger Loading Ramp

A new passenger loading ramp that sells for $5400 and can be used with all types of four-engine airplanes has been announced by the Texas Metal and Manufacturing Co. The new Tex-Met ramp weighs 2500 pounds, measures 221″ long, 93″ wide, and has an overall height of 175″. It is adaptable for use with Boeing 377, Lockheed Constellation, and Douglas DC-4, DC-6, and DC-7 aircraft.

The ramp is hydraulically operated, with a hand-operated hydraulic pump and a 2½″ hydraulic ram used to adjust the upper platform height to cabin entrance levels which vary from 80″ to 130″ from the ground. Hardened steel ratchets, one on each side of the hydraulic ram, allow for accurate positioning of the platform height and provide a positive safety should the hydraulic system fail.

Address: **Texas Metal and Manufacturing Co.,** 6114 Forest Park Rd., Dallas, Tex.

Wattmeter. Electronic wattmeter designed for power measurement on low impedance devices is now being marketed by Kiethley Instruments. The model 110 meter, as it is called, has a range from .3 to 300 watts on six scales. Accessory shunts extend this range up to 9000 watts.

Kiethley model 110 is said to have an accuracy within 2% of full scale, and its uses include transformer core loss testing, and power measurement to fuses, fusible links, small aircraft motors, lamps and ballasts.

Address: **Kiethley Instruments,** 3868 Carnegie Ave., Cleveland 15, Ohio.

Time Indicator. The Marion Electrical Instrument Co. has introduced a new model HM2ET counter-type elapsed-time indicator which is said to be absolutely tamper-proof and immune to environmental conditions of humidity, temperature, and dangerous atmospheres. De-

signed to meet standard 2½" joint AN specifications for panel mounting, the new meter is available with register in 1/10th hour steps to 9999.9 hours, or in one hour increments to 99999 hours.

Address: **Marion Electrical Instrument Co.**, Manchester, N. H.

Knee Board. For pilots or navigators, this many-purpose knee board now being marketed by the Semco Research Co. weighs nine ounces and uses an adjustable quick-release strap which holds the board securely to the leg. Constructed from a solid black molded non-specular material, the board provides two pencil storage compartments, a coil spring pencil rest, built-in sharpener, and an upper and lower chart-holding spring clip. Extra equipment produced for the knee board includes a stop watch bracket and a Nite-Lite bracket to fit any standard pen light.

Address: **Semco Research Inc.**, 212 West Florence Ave., Inglewood, Calif.

Light Dimmer. A Polaroid pilot light dimmer, developed for use by CAA in control tower installations, gives a continuous and smooth dimming of pilot light intensity from full-on to blackout, according to its manufacturer, the TLG Electric Corp. The new unit, called the model A-CA-03C dimmer, is made from non-ferrous materials throughout and is finished in a non-reflective black oxide. The dimmer accommodates lamps of the NE-51 and No. 47 size.

Address: **TLG Electric Corp.**, 31 West 27 St., New York 1, N. Y.

Fueling Adapter. For single-point aircraft fueling systems, the Buckeye Iron & Brass Works of Dayton, O., has introduced a new aircraft adapter to mate with its recently announced single-point fueling nozzle. Both are designed to conform to U. S. Air Force and Navy Bureau of Aeronautics specifications.

The new adapter, which mounts under the wing, features a tapered seat construction which is self-centering and cannot cock. The Buckeye nozzle is self-adjusting to fit any qualified adapter, and couples, locks, and controls flow in one motion.

Address: **Buckeye Iron & Brass Works**, Dayton, O.

Drafting Aid. New drafting devices called Transeals, which are said to provide improved title blocks, bills of materials, and technical symbols for engineering drawings, have been announced by the Johnson Research Corp. Transeals are thin transparent printed plastic sheets with a pressure-sensitive adhesive coating protected by a removable waxed paper.

Advantages of the new drafting tools are their elimination of rubber stamps, time consuming hand-lettering, and the ruling usually required for engineering drawings whether on paper, vellum, or cloth. The Transeals are easily applied by slight hand pressure, without the use of heat, either to the face or reverse side of drawings.

Address: **Johnson Research Corp.**, Bethpage, N. Y.

22 LEADING WORLD AIRLINES HAVE SELECTED TURBO COMPOUNDS
TCA
TRANS CANADA AIR LINES selects
TURBO COMPOUNDS
to Speed its North Atlantic Service with
LOCKHEED Super CONSTELLATIONS
CURTISS-WRIGHT
World's Finest Aircraft Engines
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UP THERE WITH THE BIG NAMES

KLM

ROYAL DUTCH AIRLINES

Flies With SKYDROL

KLM Royal Dutch Airlines is an experienced user of Skydrol, Monsanto's fire-resistant hydraulic fluid.

Skydrol is now specified by 18 major air lines. Here are the reasons for this wide and growing acceptance:

THIS BOOK contains complete specifications and technical data on Skydrol. For your copy, write: Monsanto Chemical Company, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Mo. *Skydrol: Reg. U. S. Pat. Off.*

● **Skydrol** is fire-resistant . . . the *only* such fluid which can be used in most hydraulic applications on your airplane.

● **Skydrol** has double the lubricity of conventional hydraulic fluids. Two million hours of service bear out this fact.

● **Skydrol** extends the service life of hydraulic components, cuts maintenance costs.

● **Skydrol** is nontoxic . . . noncorrosive . . . stable at required operating temperatures and pressures.

MONSANTO CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

"COMO SE LLAMA?" "*What is it called?*" Spanish explorers asked when they saw the curious animal. That's how the llama got its name

"Nowhere else in the world but in South America . . ."

" . . . nowhere else, can you see graceful llamas loping up the hillsides. They're a symbol of good luck."

And just as unique to South America is Panagra's "Fiesta Lounge" aboard *El InterAmericano*, where you see home-coming passengers showing silver keepsakes. This is the famous lounge where you can relax in comfort while, far below, distance sweeps by at 300 miles an hour. The "Fiesta Lounge" flight of *El InterAmericano* . . . world's fastest DC-6 . . . only 16¼ hrs. in the air from Miami to Buenos Aires.

Deluxe *El InterAmericano* and thrifty *El Pacifico*, fastest tourist service on South America's West Coast, fly over the routes of PAA and Panagra. Call your Travel Agent or Pan American World Airways, U. S. Sales Agent for—

Frye Speed Trophy won by El InterAmericano

PANAGRA

Pan American-Grace Airways

Airline Commentary

By Eric Bramley

FROM NOW ON, local time is to be used in domestic timetables during daylight savings seasons. The Air Traffic Conference voted the resolution unanimously at its Dallas meeting. There wasn't even any discussion—a sharp contrast with last summer, when the debate went on for weeks by mail and phone before everyone agreed. It's a welcome addition to standard airline practice.

•

Les Barnes, president of Allegheny Airlines, is to be congratulated on his editorial in the company's houseorgan. He points out that in the lowest winter month Allegheny's business is about 60% under the summer level—despite the fact that there's as much or more traffic available. The reason is that when the weather turns bad passengers aren't kept well enough informed about cancellations, delays, etc. Consequently they turn to other forms of transport.

"One word summarizes the key to a successful winter's operation—information," he says. "If each of us fulfills his responsibility, we will not lose our passengers this winter. If we fail, if we do not keep our passengers informed, then we deserve to lose them, because we have violated a trust placed in us. Each time we fail, we double-cross our passengers!"

•

Philippine Air Lines last month was forced to delay for one day the departure of a flight from San Francisco. When the passengers finally boarded, they received mimeographed letters, signed by Ed Bolton, PAL's vice president, apologizing for the delay and thanking them for their consideration.

"The causes for the delay did not involve your safety; rather it was a precautionary decision to avoid the possibility of a delay enroute to Manila," he said. "The maintenance facilities provided PAL aircraft by United Air Lines are unexcelled and the decision was made to correct certain malfunctions . . . prior to departure . . . Your captain between here and Honolulu, Capt. Jay Vincent, will be pleased to discuss the problems which led to our decision . . . At the first opportunity he will be in the passenger compartment, and we would like you to feel free to talk to him . . . Our Manila office is . . . fully advised of the delay and is in a position to answer any inquiry of your friends." An A-1 example of how to keep passengers fully informed.

•

Recently we had the pleasure of attending the preview of the movie, "Wings Over Dexter," produced by American Airlines and the local service airlines. It does a top-notch job of explaining the role of the local carriers, who will find it very valuable in their sales work. It's to be shown in local service communities all over the country. See it if you get a chance.

•

IDEA MART: Trans-Texas Airways figured one way to get people to **carry its timetables** around with them was to include the schedule of Southwest Conference football games. It's working . . . Bonanza Air Lines is making effective use of 2¢ **postcards to promote air freight.** Cards are typed, thus holding down expense. Each one includes a catchy poem about air freight, together with full information on routes, flights, etc . . .

•

ODDS AND ENDS: 875 TWA employes will go from U. S. to Europe and 93 Europe-U. S. in company's latest familiarization program. An excellent undertaking that should pay big dividends . . . Good news: Murray Barnes is now acting advertising manager for Pan American World Airways. Highly regarded as a smart ad man . . . Clearest loudspeaker, clearest voice, clearest enunciation at an airport: United at Chicago . . . American Airlines' automatic reservations system (Reservisor) in New York is working out even better than might have been expected. Amount of time it's been out of service for repair is a fraction of one per cent . . .

People

MANUFACTURING

Harold E. Cooper has been promoted to vice president in charge of sales and customer relations of Angelus Aircraft Co., Los Angeles.

Dean C. Smith has joined Lear, Inc. as director of customer relations. Prior to joining Lear, Smith was director of customer relations for Hughes Aircraft Co.

Dr. William E. Shoup has been named assistant division manager in charge of development for Westinghouse Electric Corp.'s Atomic Power Division. Shoup, formerly director of development for the Atomic Power Division, is co-discoverer of photofission—splitting of uranium atoms by high speed gamma rays.

Clay P. Bedford has been appointed vice president in charge of the newly consolidated electronics research and production facilities formerly operated as separate Kaiser Motors Corp. and Willys Motors, Inc., divisions.

Bedford

Lanphier

Thomas G. Lanphier, Jr., vice president and assistant to the president of Consolidated Vultee Aircraft Corp., has been elected president of the National Aeronautic Association. Lanphier succeeds **Harry K. Coffey**, U. S. representative of the Federation Aeronautique Internationale.

Robert A. Wagner has been appointed chief engineer for Hiller Helicopters. Wagner comes to Hiller from the Aircraft Division of McCulloch Motors, where he was chief engineer.

I. J. Dienhart, former manager of Indianapolis Mun. Airport, is now sales manager for Klincher Locknut Corp., Indianapolis.

Richard M. Degen has been named to the newly created post of chief engineer of Hydro-Aire, Inc. Degen was formerly associated with McDonnell Aircraft Corp.

Douglas Knowles, former chief engineer of the Gas Turbine Division of A. V. Roe Canada, has been appointed assistant manager of Continental Aviation & Engineering Corp.'s Turbine Division.

AIRLINES

Georg Unger Vetlesen, who retired last month as chairman of the board of Scandinavian Airlines System because of his health, has been succeeded by **Edwin F. Chinlund**, vice president and treasurer of R. H. Macy & Co. **Berent Friele**, vice president and director of

SOUTHERN AIRWAYS AT ATLANTA, GEORGIA. Popular service stop-over for many industrial, executive, corporation and personal planes heading for Florida from Midwest and Northwest.

Popular, Dependable Service-Point For Many Florida-Bound Aircraft

ARMY FIELD FORCES SCHOOL at Southern Airways, Atlanta, teaches instrument flight training to Army Aviators of 3rd Army, Fort McPherson, Georgia.

CITIES SERVICE
AVIATION PRODUCTS

Southern Airways at Atlanta And Birmingham Services More Businessmen's Aircraft Than Any Other Fixed Base Operation In Southeast! . . . With Cities Service Aviation Products!

Here's another spot on the airmap of America where a top-flight aircraft service organization relies on the consistent high quality and ultra-dependability of Cities Service Aviation Products.

Southern Airways service facilities include Radio Shops and approved CAA Repair Stations. They are also the leading distributors in dollar volume of Beech Aircraft and parts.

Wherever you fly through the Southeast, make Southern Airways your service stop. You'll always be assured of the highest quality service with America's finest Aviation Products . . . the complete line of Cities Service Aviation Products.

the International Basic Economy Corp., has been named to fill the board vacancy created by Vetlesen's resignation.

Clarence E. Liske, formerly director of North Central Airlines' reservation and ticket sales, has been appointed to the newly created position of general traffic manager of NOR.

Dwight D. Taylor, Jr., has been named assistant to American Airlines' vice president **Carlene Roberts.**

H. Don Reynolds will join Northwest Orient Airlines November 15, as executive assistant to the president. Reynolds was formerly an attorney with Pan American World Airways.

Harry J. Miller is the new comptroller of KLM Royal Dutch Airlines' North American Division.

Jeanette Phillips has been appointed superintendent of hostessses for Trans World Airlines' central region. Prior to her transfer to Kansas City, Miss Phillips was assistant superintendent of hostesses in Chicago.

The following employes have recently completed 20 years or more of service in the aviation industry:

• **Juan F. Aguirre,** Pan American World Airways. Assistant traffic manager, Miami. 25 years.

• **Mario J. Martinez,** Pan American World Airways. Latin American Division traffic and sales manager, Miami. 25 years.

• **H. J. Reid,** Capital Airlines. Manager of flight operations, Washington. 20 years.

• **James M. Shutt,** Capital Airlines. Captain, Washington. 20 years.

• **W. L. Clampitt,** Chance Vought Aircraft. Buyer, East Hartford. 20 years.

• **C. L. Wilcox,** Chance Vought Aircraft. Test lab milling machine operator, East Hartford. 20 years.

• **Edward Ingraham,** Chance Vought Aircraft. Foreman of turning and grinding, East Hartford. 20 years.

• **W. C. Schoolfield,** Chance Vought Aircraft. Chief of aerodynamics, East Hartford. 25 years.

• **J. A. Krampe,** Chance Vought Aircraft. Foreman of tool inspection, East Hartford. 25 years.

• **H. B. Lathrop, Jr.,** United Air Lines. Assistant manager of station ground services, Toledo. 20 years.

• **W. P. Mumaugh,** United Air Lines. Assistant foreman, San Francisco. 20 years.

• **Ruth G. Uhl,** United Air Lines. Sales, Des Moines. 20 years.

• **Noble Shropshire,** North American Aviation. Director of contract negotiations, Los Angeles. 25 years.

• **Bill Hoffman,** Northwest Airlines. Accessory shop mechanical supervisor, St. Paul. 25 years.

• **Lou Koerner,** Northwest Airlines. Maintenance division manager, St. Paul. 25 years.

BRAIN SURGEONS...

FOR GUIDED MISSILES

Guided missiles are, fundamentally, planes without pilots . . . officially referred to as "pilot-less" aircraft. But, *something* must take the place of the human element to make the missile work . . . to fulfill its mission.

The problem of developing that "something" . . . a replacement for the pilot . . . is a challenging assignment for highly trained scientists and engineers such as the "brain surgeons" of Bell Aircraft's large and diversified electronics and servomechanisms departments.

Complex electronics systems are the "brains" of a missile. Servomechanisms provide the "muscles." Development of successful "brain-muscle" systems is typical of the advances made by Bell Aircraft engineers for our armed forces.

Bell's electronics and servomechanisms programs also include design and production of various types of radar, proportional control equipment, telemetering systems, automatic landing devices and several different types of auto-pilots.

Thorough research, advanced engineering and sound production which distinguish Bell products will provide major contributions to transportation, commerce, industry . . . and the future defense of our nation.

BELL Aircraft CORPORATION

Buffalo, N. Y. Fort Worth, Texas

Engineers interested in career opportunities—write Engineering Personnel Dept., Buffalo.

Domestic Fares Under Study

A comprehensive study of the domestic airline fare structure, reaching into all elements of price construction, was touched off last month with a meeting of top CAB staff officials and representatives of the 13 trunk airlines.

FitzGerald

Called for last May when CAB dismissed its General Passenger Fare Investigation (a formal economic case), the new study does not contemplate any "drastic over-night" fare changes. But if carried to completion, it promises as near-perfect a fare structure for the future as the art of economics will permit.

CAB's new air operations bureau director, Joseph H. FitzGerald, with the assistance of Irving Roth, rates division chief, is spearheading the Board's staff study.

Here are some of the far-reaching points which will be explored:

- **Historical earnings** of airlines;
- **Variations in fares** between (a) carriers, (b) regions, (c) competitive and non-competitive points, (d) coach and standard fares, and (e) rail and air fares, among others.
- **Evaluation** of different standards available for testing reasonableness of fare levels, covering such topics as "fair return," "operating ratios," and "equalization reserves."

Unlike the General Fare Investigation which was dismissed, the new study is an informal approach which will see CAB and industry experts combine their efforts and data for the ultimate development of staff recommendations to the Board.

The present fare structure of the industry stems from a basic level of 6.1¢ per passenger-mile for standard or first-class travel, irrespective of distance involved. From that level stem the 4¢ and 4½¢ coach fare levels, the half-fare family plan charges, and various type excursion fares.

Five years ago the basic fare level produced substantially all of the airlines' passenger revenues. Today, in some cases, it accounts for only about 50% of the overall total. CAB and many in the industry feel it is time to search deeply into the economic factors that go into construction of sound overall fare level.

The machinery for the study is currently being worked on. After it is finished, according to FitzGerald, facts will be exchanged, and future Government-industry meetings held. Application of piecemeal results of the study may be made to meet certain situations, but the overall aim is to come up with a sound basis for an industry fare structure for the future.

CAB MISCELLANY

Pioneer Air Lines has applied for higher mail pay for its reinstated DC-3 operations, requesting temporary pay of $1,702,866 annually as compared to present $1,137,377.

•

Resort Airlines wants CAB to continue for another year an exemption under which agricultural workers have been transported from the West Indies to various U. S. points.

•

Western Air Lines applied for extension of Route 13 beyond Yuma, Arizona, to Phoenix.

•

Riddle Airlines applied for exemption to render all-cargo service to Orlando, Fla., on flights to and from New York.

•

American Airlines asked CAB to remove a restriction from its Route 4 certificate which requires Louisville-New York flights to serve Cincinnati.

•

Northwest Airlines urged CAB to grant it permanent and exclusive rights to route between Pacific Northwest and Hawaii by denying Pan American renewal application.

•

Seaboard & Western Lines' "answer" to Pan American's trans-Atlantic rate cut is elimination of general commodity rates for shipments of 1000 pounds and over. S&W will concentrate on specific commodity rates for individual shipments.

•

A National Airlines subsidiary, Public Service Broadcasting, Inc., has applied to FCC to operate a television station in the Miami area.

CAB News

AS OF NOW . . .

The **Additional Southwest-Northeast Service Case,** largest of the three major route cases which got under way this year, was side-tracked briefly for a second prehearing conference recently but should go to hearings around the first of the year.

Hearings will begin this month in the **Airwork Limited Foreign Permit Case,** which raises for the first time the question of a foreign carrier operating trans-Atlantic all-cargo service. Airwork is a British independent company.

Final decisions are expected soon in the **Pan American Miami-New York Ferry Flight Investigation,** the **North American Airlines "Name" Case, Reopened Southern Service to the West Case,** and the **Air America Enforcement Proceeding.**

RECENT CAB DECISIONS

- **Allegheny Airlines** named as potential transferee for "all or part" of Lake Central Airlines' Route 88, joining North Central and Ozark in that capacity.
- **Airlines directed** to effect new tariffs no later than November 20, to bring air freight rates up to new minimums of 20¢ per ton-mile up to 1000 ton-miles and 16.25¢ beyond.
- **Trans-Caribbean Airways** turned down on exemption bid to operate low-fare "air-bus" service between U. S. and Puerto Rico.
- **West Indies Airways** granted exemption to operate "regular and frequent" service as air taxi operator between designated points in Puerto Rico.

CAB CALENDAR

Nov. 9—Hearing in New Mexico Service Case (Continental Air Lines, et al.). Albuquerque, N. M. Docket 5869 et al.

Nov. 16—Hearing in Braniff Route 106 Renewal Case. Washington, D. C. Docket 6050 et al.

Nov. 30—Hearing in Fayetteville Service Case. Tentative. Docket 5592 et al.

Nov. 30—Hearing in Lake Central Acquisition Case. Washington, D. C. Docket 5570 et al.

Nov. 30—Hearing in Airwork Limited Trans-Atlantic Permit Case. Washington, D. C. Docket 6188.

Dec. 1—Hearing in Niagara Falls Airport Case (American Airlines). Niagara Falls, N. Y. Docket 6125.

Dec. 1—Hearing in TACA International Airways Foreign Permit Case. Washington, D. C. Docket 5476.

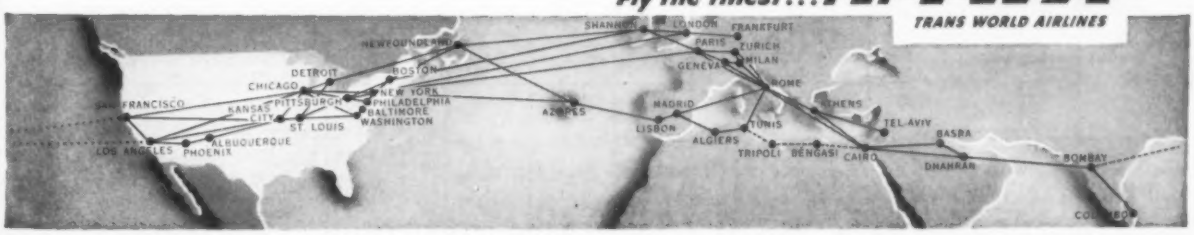
How to go a long way and not be away long

Today's businessman has a new answer to the traditional family send-off. It's the cheerful "See you soon" that goes with traveling TWA. Five-mile-a-minute Constellations speed him to far-off business appointments in hours . . . overnight if his trip is overseas. And not only does he get there sooner, he can stay longer . . . take all the time he needs to get results. For in back of his mind is the reassuring thought that there's another TWA Skyliner just waiting to speed him home.

Where in the world do ***you*** *want to go? For information and reservations call TWA or see your travel agent.*

Fly the finest... FLY TWA

TRANS WORLD AIRLINES



Domestic Airline Revenues and Expenses for Quarter Ending June 30, 1953

Compiled by American Aviation Publications from Official C.A.B. Data.

AIRLINES	TOTAL OPERATING REVENUES	PASSENGER REVENUES	MAIL REVENUES	EXPRESS REVENUES	FREIGHT REVENUES	EXCESS BAGGAGE REVENUES	NON-SCHEDULED TRANSPORT REV.	TOTAL OPERATING EXPENSES	AIRCRAFT OPERATING EXPENSES	GROUND & INDIRECT EXPENSES	NET OPERATING INCOME BEFORE INCOME TAXES
American	$ 53,153,457	$ 46,631,451	$ 1,922,996	$ 1,080,056	$ 2,511,037	$ 536,445	$ 181,236	$ 43,247,675	$ 21,983,349	$ 21,264,326	$ 9,905,782
Braniff *	7,421,360	6,687,661	252,157	121,457	194,515	55,412	75,559	7,435,492	3,792,864	3,642,628	-14,132
Capital	12,405,697	11,146,634	305,973	324,729	256,343	66,127	130,063	10,833,547	5,138,055	5,695,492	1,572,150
Caribair	289,236	231,571	34,975	....	6,971	1,864	2,172	277,502	112,961	164,541	11,734
C & S **	1,340,957	1,217,785	46,711	35,835	25,477	10,745	....	1,219,057	595,653	623,404	121,900
Colonial	1,641,877	1,426,079	103,814	15,682	23,413	13,910	54,875	1,568,108	670,452	897,656	73,769
Continental	2,730,325	2,429,509	158,010	21,291	58,748	19,897	604	2,595,679	1,363,830	1,231,849	134,646
Delta-C&S ***	10,185,442	9,165,077	341,286	192,591	310,161	106,011	2,480	9,885,080	4,914,246	4,970,834	300,362
Eastern	34,554,397	31,920,267	681,643	442,289	362,941	501,651	37,856	30,773,007	17,669,553	13,103,454	3,781,390
Hawaiian	1,220,258	853,874	174,312	....	168,788	14,217	5,514	1,228,458	537,330	691,128	-8,200
National	7,620,289	6,707,653	196,103	61,271	317,023	124,483	14,727	6,671,103	3,373,402	3,297,701	949,186
Northeast	2,295,560	1,451,434	753,650	22,774	38,176	7,292	5,002	1,960,548	838,338	1,122,210	335,012
Northwest	12,078,517	10,817,673	467,560	201,477	343,231	88,548	22,712	10,342,312	5,613,757	4,728,555	1,736,205
Trans Pacific	449,774	324,983	99,855	1,221	11,209	1,915	1,537	424,459	164,840	259,619	25,315
TWA	35,954,795	32,067,615	1,422,774	761,854	1,006,524	272,125	39,021	30,485,793	16,538,613	13,947,180	5,469,002
United	42,617,405	37,100,260	2,092,950	1,025,658	1,494,169	351,443	35,082	34,665,173	15,949,145	18,716,028	7,952,232
Western	5,702,020	5,157,926	202,606	86,113	107,916	30,813	4,455	5,034,874	2,579,929	2,454,945	667,146
TOTALS	231,661,366	205,337,452	9,257,375	4,394,298	7,236,642	2,202,898	612,895	198,647,867	101,836,317	96,811,550	33,013,499

* Braniff's figures do not include operations of local service route 106 operated by Braniff as result of Braniff-MCA merger.
** Figures for C & S are for month of April only. Merger between Delta Air Lines and Chicago and Southern Air Lines was effective May 1, 1953.
*** Merger between Delta Air Lines and Chicago and Southern Air Lines was effective May 1, 1953.

Local Service Revenues and Expenses, Six Months Ending June 30, 1953

AIRLINES	TOTAL OPERATING REVENUES	PASSENGER REVENUES	MAIL REVENUES	EXPRESS REVENUES	FREIGHT REVENUES	EXCESS BAGGAGE REVENUES	NON-SCHEDULED TRANSPORT REV.	TOTAL OPERATING EXPENSES	AIRCRAFT OPERATING EXPENSES	GROUND & INDIRECT EXPENSES	NET OPERATING INCOME BEFORE INCOME TAXES
Allegheny	$ 1,934,230	$ 855,876	$ 1,008,707	$ 35,787	$	$ 3,671	$ 12,419	$ 1,945,125	$ 884,839	$ 1,060,236	$ -10,895
Bonanza	823,183	463,522	320,347	8,971	8,646	4,371	14,030	895,448	386,111	509,337	-72,265
Braniff*	312,396	293,929	5,822	5,771	5,233	1,067	...	527,626	221,125	306,501	-215,230
Central	1,138,224	193,855	922,811	4,348	7,209	3,152	4,586	1,074,880	497,729	577,151	63,344
Frontier	2,425,946	835,251	1,468,174	14,381	66,496	4,537	28,601	2,366,599	1,070,795	1,295,804	59,347
Lake Central	759,083	183,846	545,404	15,375	....	966	7,183	879,941	377,729	502,212	-120,858
Mohawk	1,280,424	823,421	406,939	17,993	15,546	2,065	7,457	1,313,993	663,180	650,813	-33,569
North Central	2,101,537	898,603	1,161,240	31,865	....	6,085	2,626	2,274,358	1,083,134	1,191,224	-172,821
Ozark	1,570,855	497,780	1,046,106	16,553	....	3,130	4,126	1,659,473	864,974	794,499	-88,618
Piedmont	2,549,694	1,638,416	817,059	20,619	34,751	13,186	15,197	2,652,726	1,379,596	1,273,130	-103,032
Pioneer	1,910,650	1,300,014	544,010	10,410	31,632	15,856	...	2,402,135	1,397,939	1,004,196	-491,485
Southern	1,602,319	558,065	1,007,905	16,057	....	3,195	2,030	1,600,639	749,557	851,082	1,680
Southwest	1,499,542	901,780	504,873	11,946	24,860	3,562	43,861	1,608,846	728,460	880,386	-109,304
Trans-Texas	1,367,394	526,986	798,472	8,146	19,113	3,770	2,305	1,448,329	620,528	827,801	-80,935
West Coast	1,619,993	767,659	821,932	7,657	10,529	3,561	5,394	1,719,100	824,924	894,176	-99,107
Wiggins	150,035	9,072	137,580	1,946	....	10	917	144,652	49,280	95,372	5,383
TOTALS	23,045,505	10,748,075	11,517,381	227,830	224,015	72,184	150,732	24,513,870	11,799,950	12,713,920	-1,468,365
					Helicopter Services						
Hel. Air Service	257,030	....	247,567	....	....	...	...	223,933	130,394	93,538	33,097
Los Angeles	338,422	....	338,412	....	....	...	...	337,604	229,670	107,934	818
N.Y.Airways**	270,670	....	269,189	....	1,370	...	...	450,899	254,165	196,734	-180,229

* Figures cover operations of local service route 106 operated by Braniff Airways as result of Braniff-MCA merger.
** U.S. mail pay figured on basis of temporary rates established by CAB at a time when no operating or cost experience regarding New York Airways was available. Rates are, therefore, subject to retroactive adjustment.

Local Service Revenues and Expenses, Quarter Ending June 30, 1953

AIRLINES	TOTAL OPERATING REVENUES	PASSENGER REVENUES	MAIL REVENUES	EXPRESS REVENUES	FREIGHT REVENUES	EXCESS BAGGAGE REVENUES	NON-SCHEDULED TRANSPORT REV.	TOTAL OPERATING EXPENSES	AIRCRAFT OPERATING EXPENSES	GROUND & INDIRECT EXPENSES	NET OPERATING INCOME BEFORE INCOME TAXES
Allegheny	$ 1,027,621	$ 513,291	$ 471,928	$ 17,196	$	$ 2,056	$ 6,957	$ 988,068	$ 448,369	$ 539,699	$ 39,553
Bonanza	424,816	235,682	164,636	6,294	4,456	2,425	10,182	453,305	198,968	254,337	-28,489
Braniff*	177,214	167,801	3,251	2,794	2,523	526	...	278,472	117,697	160,775	-101,258
Central	691,092	107,438	569,769	2,480	3,619	1,836	4,586	546,117	252,963	293,154	144,975
Frontier	1,210,504	418,323	734,878	7,628	35,965	2,279	7,285	1,178,482	517,999	660,483	32,022
Lake Central	490,645	124,716	352,331	9,532	....	622	3,023	557,930	239,730	318,200	-67,285
Mohawk	698,593	491,673	181,084	7,652	8,199	1,360	4,595	686,930	351,985	334,945	11,663
N. Central	1,224,212	577,122	623,683	16,501	....	3,940	2,141	1,245,916	599,563	646,353	-21,704
Ozark	841,282	300,731	525,943	9,085	....	1,928	2,084	849,968	444,581	405,387	-8,686
Piedmont	1,399,826	954,900	389,110	10,436	13,332	7,622	10,985	1,378,423	724,877	653,546	21,403
Pioneer	953,822	627,204	293,882	5,181	14,913	7,787	...	1,133,304	674,639	458,665	-179,482
Southern	813,107	301,207	496,588	7,630	....	1,583	830	789,713	375,359	414,354	23,394
Southwest	825,236	513,828	247,770	6,242	11,992	1,866	40,246	873,334	405,519	467,815	-48,098
Trans-Texas	695,082	273,629	395,745	3,973	10,763	2,076	730	749,903	319,952	429,951	-54,821
West Coast	1,120,262	433,698	670,708**	4,130	5,922	2,046	2,368	907,677	452,680	454,997	212,585
Wiggins	79,096	5,937	70,984	1,258	....	9	486	73,236	25,437	47,849	5,859
TOTALS	12,677,410	6,057,130	6,192,290	113,057	117,234	39,961	96,498	12,690,828	6,150,318	6,540,510	-13,418
					Helicopter Services						
Hel. Air Service	139,718	....	132,719	....	....	...	...	110,829	64,503	46,326	28,889
Los Angeles	187,478	....	187,470	....	....	...	...	176,495	121,488	55,007	10,983
N.Y.Airways***	149,399	....	148,300	....	989	...	...	252,352	142,720	139,632	-102,953

* Figures cover operations of local service route 106 operated by Braniff Airways as result of Braniff-MCA merger.
** Mail revenues for West Coast include $286,283 applicable to first quarter 1953.
*** U.S. mail pay figured on basis of temporary rates established by CAB at a time when no operating or cost experience regarding New York Airways was available. Rates are, therefore, subject to retroactive adjustment.

INTERNATIONAL AVIATION

Edited by Anthony Vandyk

INTERCOM

Industry leaders have been particularly outspoken in recent weeks. Air France chairman Max Hymans has predicted that the Lockheed Super Constellation "will be King of the Atlantic for at least three years." His North American manager, Henri J. Lesieur, quotes a commonplace French expression—"To each problem there is a remedy"—in connection with Air France's thinking that at the present stage of aviation progress there is a place for pistons and a place for jets. BOAC chairman Sir Miles Thomas, on the other hand, says, "The future undoubtedly lies with the gas turbine but some engineers continue to coax piston engines with fuels so rare that they seem to be mixtures of liquid dynamite and fluid gold. While these technicians are dragging at already tired exhaust gases to give piston engines their last dregs of power, jet engineers are fostering the lusty adolescent that is now gaining strength and stamina with a diet of simple kerosene."

Indication that delivery dates and credit terms were the main factors behind the decision to acquire four Convair 240's and four Super Constellations as the Lufthansa's initial equipment has come from Hans M. Bongers, the man most directly connected with the revival of the German airline. He also stated: "Although we bought American aircraft we are quite free in our future selection. Next to German aircraft we would prefer European planes for currency reasons and also having regard to the ease of getting spare parts and service." Lufthansa will start operations within Europe next spring and on the North Atlantic in '55.

Criticism of the fire power of modern fighters has been voiced by Gordon McGregor, a distinguished wartime fighter pilot who is now president of Trans-Canada Air Lines and of the International Air Transport Association. He points out that a modern fighter costs about 10 times as much as its 1944 counterpart yet can do little or no more damage. Describing the modern fighter as "a can of worms," McGregor plumps for the stripped-down aircraft, since he doubts whether any nation could produce a sufficient number of skilled man-hours of work to make good wartime wastage.

U.S. to Pull Weather Ships from Atlantic

Termination of the ICAO-coordinated North Atlantic ocean weather station program is indicated as a result of the U.S. government's decision to withdraw its participation on June 30, 1954. The U.S. does not make cash contributions to the program but operates 5½ of the 10 stations with 14 Coast Guard ships at an estimated cost of $16 million. Withdrawal of the 14 ships will leave only 11 vessels to operate 10 stations, an unworkable arrangement, since two to three ships are required to keep each station in full operation.

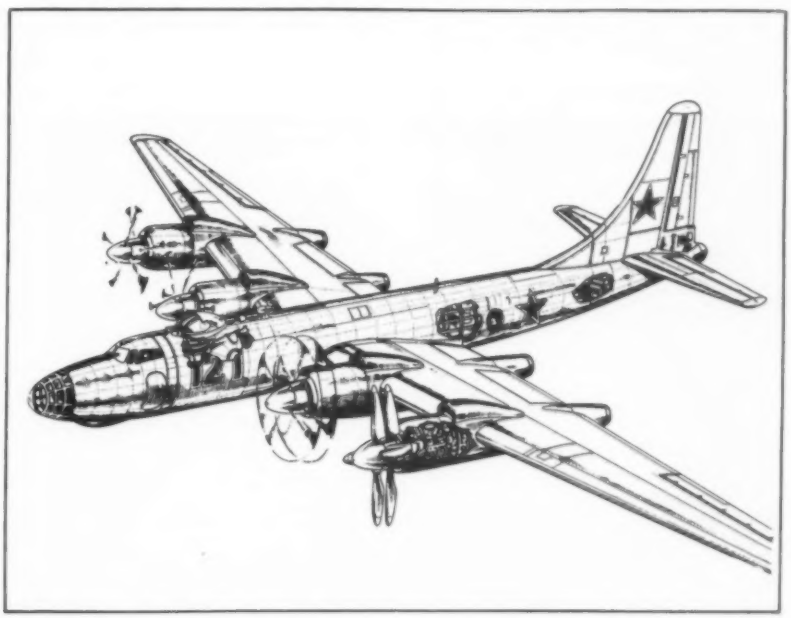
The U.S. government feels "that the services provided by the ocean stations are no longer required by the U.S. and that the benefits derived by the U.S. are no longer commensurate with the cost. . . . Taking into consideration the views of the air carriers . . . continued participation in the program cannot be justified."

A partial stamp of approval of the U.S. action has come from the International Air Transport Association which says "it will make no difference to the safety of international airline operation over the North Atlantic."

IATA points out, however, that "while there is no vital operational need for these vessels in assuring communications or navigating, the airlines have made extensive meteorological observations by these vessels, and it is hoped that the weather data which they presently provide will be supplied to the airlines by some other means."

The Air Line Pilots' Association has repeated an earlier declaration of the stations' value from the search and rescue angle, whereas the International Airline Navigators' Council has evolved a substitute program consisting of having navigators exchange weather information by radio and with meteorological officials stationed at airports (as has been done on an informal basis for several years).

The ocean station program is participated in by 15 nations whose territories ring the North Atlantic: Belgium, Canada, Denmark, France, Iceland, Ireland, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and U.S.



Russia's Type 31 bomber has contrarotating propellers driven by PTL-022 gas turbines. Details of the aircraft and its engine were published in AMERICAN AVIATION August 31. The Type 31 is now coming into operational service with the Red Air Force.

INTERNATIONAL AVIATION

MANUFACTURING

BRITAIN: There are now some 225,000 workers in the aircraft industry with the labor force increasing by about 2000 a month. About 15% of the workers are women.

Fokker S.14 jet trainer recently started its flight test program with a Rolls-Royce Nene instead of the previously-installed Derwent. Modification involved rebuilding rear fuselage.

AUSTRALIA: Commonwealth Aircraft Factory has produced the 73rd and last Avro Lincoln bomber for the RAAF and is now concentrating on Avon-Canberra and missile production.

FRANCE: Experimental Dassault Mystere IVB with afterburner-equipped Rolls-Royce Avon has started its flight tests.

Atar-powered Arsenal 1402 experimental delta will soon start its flight test program.

NETHERLANDS: Fokker and other Dutch companies will build a total of 204 Hawker Hunters under license, including 48 (at a cost of $18 million) under the U.S. off-shore procurement program.

AIRLINES

MEXICO: Aerovias Guest has started tourist service over its Miami-Mexico City route. Carrier expects to receive permission to inaugurate its long-planned Mexico City-New York route next year.

INDIA: Air-India International has converted all its Constellations into mixed-class aircraft accommodating eight first-class and 44 tourist passengers.

ARGENTINA: Aerolineas Argentinas is planning to order 15 Convair 340's, subject to dollar exchange approval by the Argentine government.

AUSTRALIA: Qantas Empire Airways will soon take over the route to North America currently operated by British Commonwealth Pacific Airlines; latter company will probably be dissolved.

NEW ZEALAND: Tasman Empire Airways is likely to take over BCPA's DC-6 fleet to replace its Short flying boats on the route between Australia and New Zealand.

BRITAIN: British European Airways is interested in the Blackburn 105, a design created in 1948 to meet a BEA feeder transport specification. With a configuration resembling the DH Heron, the model would be powered by four 180-hp Blackburn Bombardier direct-injection four-cylinder in-line engines. Take-off and landing performance would better the Heron's.

Hunting-Clan Air Transport Ltd. is a new company capitalized at $2,800,000 with the Hunting and Clan steamship companies as equal partners. It will take over the operations of Hunting Air Transport.

PHILIPPINES: Philippine Air Lines has substituted Beirut for Lydda as its Near East intermediate.

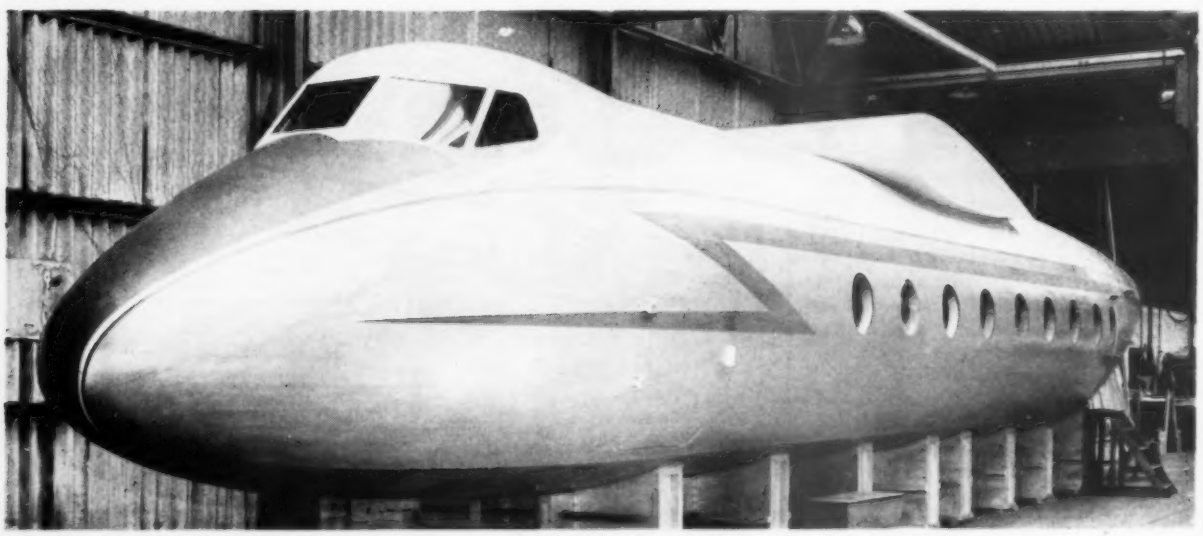
KOREA: Korean National Airlines plans to start "first-class service at tourist fares" to the U.S. on or about January 1 using its recently-delivered DC-4. KNA has bought a Hiller helicopter for domestic mail service and has ordered two more for spring delivery. The carrier is also reported to be negotiating for Super Constellations.

MILITARY

FRANCE: The French Air Force is scheduled to receive 34 Nord 2501 Noratlas freighters before next June. From June onwards SNCA du Nord will produce the twin-engine transports at the rate of five monthly.

NETHERLANDS: Lt. General A. Baretta has succeeded Lt. Gen. I. A. Aler as chief of staff of the Netherlands Air Force.

ETHIOPIA: A batch of Lycoming-powered Saab-91B Safir trainers has been ordered by the Ethiopian Air Force. Production is being handled by de Schelde in the Netherlands since the Swedish firm is too busy with other military commitments.



Handley Page HPR.3 "DC-3 replacement" has now reached the mock-up stage. Details of the four-engine transport appeared in AMERICAN AVIATION August 31.

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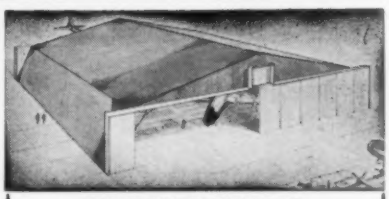

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A new type of commercial pilot examination which will virtually eliminate the possibility of "buying" a passing grade through the use of an answer book is being tried experimentally by CAA. If successful, the new test outline will be adopted as standard early next year, and may be used as a basic pattern for all other airmen examinations.

CAA's new approach is to base the examination on a hypothetical flight which can be varied to cover an indefinite number of hypothetical routes. Instead of working the examination from memory, the pilot being tested is given weather maps, aeronautical charts and copies of the Airman's Guide. The format provides 100 multiple choice questions, lasts four hours, and can be machine-graded.

Technical Literature

FUEL PUMP & TURBINE STARTER: Two new bulletins deal with a tank-mounted afterburner fuel pump for aircraft and the new aircraft gas turbine starter; designated Bulletin GEA-5871A and GEA-5872A, respectively. General Electric, Schenectady, N. Y.

COMPANY STORY: "50 Years—A Start for the Future" is a 24-page book published by Standard Press Steel Co. of Jenkintown, Penna. describing the company's plans and facilities.

GEARS AND REDUCERS: Catalog No. 70 contains 176 pages of technical data on stock gears, speed reducers, and special gears manufactured by Grant Gear Works, Inc., Boston 27, Mass.

ELECTRICAL RESISTERS: Latest data on methods of using Thermistors, heat-sensitive electric resisters with negative temperature coefficients, is presented on four technical data sheets —TH-9, 10, 11, and PM-116 issued by the Carboloy Dept. of General Electric Co., Detroit 32, Mich.

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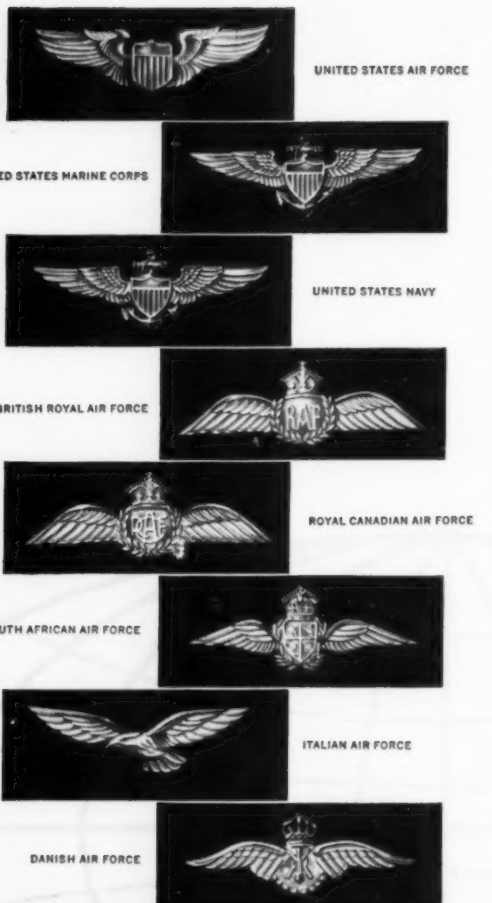

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Airline Stocks Seen Headed for 'Blue Chips'

Airline securities as a sound investment are headed in the right direction, according to CAB's new top staff member, Joseph H. FitzGerald. Recently appointed to head the Board's all-important air operations bureau, FitzGerald gave AMERICAN AVIATION his opinion that it is "only a matter of time" until airline stocks "enter the blue chip field."

FitzGerald does not feel that instability in the industry necessarily keeps sound investors away, but that, because airlines have had to pour earnings back into their operations, dividends generally may have not been such as to attract the investor.

A Rhodes scholar and former head of CAB' Alaskan Office, FitzGerald views as the primary purpose of CAB the "development of a fundamentally sound air transport system that can weather any storm."

He is also well acquainted with the job being performed by Alaskan carriers and claims the Government is getting "its money's worth." He is still getting acquainted with the local service industry's problems which developed during his stay in Alaska.

Economics Delays DC-3 Replacements

The economic hardships of the U. S. local service carriers have been cited by Canadair, Ltd.'s chief sales engineer, Karl Larsson, as one of five major reasons for the absence of a DC-3 replacement from the market today.

Speaking before the Canadian Aircraft Technicians Association in Montreal recently, Larsson viewed the remaining world market for a feeder type transport as about the same in size as that in the U.S., but divided into so great a number of customers that it is impossible to expect initial orders large enough to support production.

Other factors retarding the airplane's development, according to Larsson include the requirement that new aircraft meet strict airworthiness requirements which handicap them economically, and the necessity of committing manpower and facilities to military projects.

As to the pricing of the projected Canadair CL-21 feeder transport, the sales executive felt that about 300 of the aircraft could be sold at $450,000 each by 1955-57, but that without military backing the unit selling price would have to be $530,000.

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News at Deadline

White House Decision Reported on CAB Fate

Reliable reports at press-time indicated the White House had made a decision with respect to the future of CAB. Either a shake-up of CAB membership posts or an executive reorganization of the agency were the most likely possibilities.

White House concern grew rapidly in the past few weeks in the light of numerous public investigations and one on the private side being conducted by the FBI. The FBI inquiries, presumably made at White House direction, were originally concerned with the CAB chairmanship, but took on a broader aspect as the investigation progressed.

Timing of the White House action was still uncertain.

All 4-Engine Transports to Be Modified

All four-engine transports owned by U. S. air carriers and private companies will eventually be modified for use by the military in case of emergency. Between 300-500 planes, in addition to the 308 now being equipped as part of the Civil Reserve Air Fleet (CRAF), will be ready to serve in military airlifts after M-day, AMERICAN AVIATION has learned.

David Bluestone, assistant to Defense Air Transportation Administrator Theodore Hardeen, Jr., has said that some four-engine transport on the assembly lines are currently being modified for possible military use, even though those planes are not slated to become part of CRAF. The USAF's Air Materiel Command, he said, has given some carriers the go-ahead to have the added equipment installed, and the remaining planes will be ordered retrofitted with the needed equipment as the required money becomes available.

The DATA official also reports that AMC has already let contracts for modifying two-thirds of the CRAF fleet, i.e., about 200 planes, and that the required work on about 100 of them has been completed. He gave the cost of modifying the DC-4's, DC-6's, Constellations, and Stratocruisers at about $7,000 per aircraft, or just over $2 million total.

Longer Course Gives YF-100 World Record

The U. S. Air Force, North American Aviation, and the YF-100 now hold the world's speed record again, despite the fact that they have not yet exceeded the mark set by a Navy Douglas XF4D by one per cent.

The new record of 754.98 mph was set by the Super Sabre over a 15-kilometer course at Salton Sea, Calif., on October 29. The XF4D record of 753.4 mph was set over a three-kilometre course on October 3.

According to Charles S. Logsdon, official timer of the Federation Aeronautique Internationale, the requirement is that a new mark must exceed an old one by one per cent only if both trials are made over courses of the same length. If one is set over the short course and the next over the long course (as in this case), the second mark need not exceed the earlier one by one per cent.

CAA Office Wiped Out

The CAA Office of Aviation Defense Requirements under director G. R. Gaillard has been eliminated. Its activities will be continued with a staff of four persons under an organizational structure still to be decided.

Gaillard has left CAA on leave of absence, and present acting director David P. Sampson has resigned. Earlier this year the OADR was cut from 27 to 11 persons.

Lindbergh Honored by Corporate Flying Group

Charles A. Lindbergh was honored by the National Business Aircraft Association during its convention in St. Louis last week as the individual who had contributed most to the advancement of aviation. The award was accepted on his behalf by E. Lansing Ray, publisher of the *St. Louis Globe-Democrat* and one of the backers of the historic New York-Paris flight in 1927.

Meritorious awards were presented to 16 NBAA member companies completing more than one million accident-free miles flown in business aircraft.

Topping the safety list were the Ohio Oil Co. of Findlay, O., with 5,261,328 miles; Monsanto Chemical Co. of St. Louis with 3,019,625; and Sinclair Refining Co. of Tulsa with 2,753,464 miles.

Other companies included Continental Oil Co.; Esso Shipping Co.; Great Lakes Carbon Corp.; International Paper Co.; Kroehler Manufacturing Co.; Malco Refineries, Inc.; National Automotive Fibres, Inc.; Pan American World Airways;; Phillips Drilling Corp; Pratt & Whitney Aircraft; H. C. Price Co.; Sears, Roebuck and Co., and Albert Trostel & Sons Co.

In addition, 42 business aircraft pilots received NBAA member-pilot proficiency awards for flying 500,000 or more accident-free miles.

No Change Planned in Amortization Rule

No change will be made in the procurement regulation which allows accelerated amortization of defense facilities as an allowable item of cost, according to Howard W. Bordner, deputy comptroller (accounting) in the office of Assistant Defense Secretary Wilfred J. McNeil.

Industry sources had expressed concern over the possibility that the amortization provision might be ignored in the revised version of the procurement regulation (Section 15), which is now being prepared under Bordner's supervision.

"No draft of the proposal has yet been released," said Bordner, "and any discussions which have so far appeared are premature."

Japan Blocks New Pacific Tourist Rates

Pacific tourists service at rates recently proposed by Northwest Airlines and Pan American World Airways will be temporarily blocked by the Japanese government, which has informed the State Department that it is dissatisfied with the fares.

The final Japanese decision will be deferred until the subject is considered by the International Air Transport Association at its traffic conference, which opened in Honolulu November 2.

There has been an open-rate situation in the Pacific because of failure of the Civil Aeronautics Board to approve certain IATA resolutions. As a result of this situation NWA and PAA filed tourist rates which were to have become effective November 15 and 20.

First USAF Jet Bomber Goes to Air Museum

The nation's first jet bomber, the Douglas XB-43, has been retired by the Air Force after years of service as a flying test bed for jet engines. The aircraft will be turned over to the National Air Museum.

Normally equipped with two Allison J35's, the XB-43 could replace one of these with an engine which was to be tested, take off using both, then throttle back the J35 at altitude and conduct tests on the one engine alone.

Such tests resulted in developments that included determination of the minimum safe lube oil flow for the G-E J47, the design of pressurized oil tanks, and improved high-altitude starting.

French Cutbacks

France's aircraft industry faces the prospect of a $5.7 million cut in government orders, most of them military. Reportedly due to suffer most are the private owned firms, particularly Breguet. Non-military work makes up less than 15% of France's aircraft business.

TCA Monopoly May Go: St. Laurent

Just how long Trans-Canada Air Lines will continue to enjoy its monopoly on transcontinental air transport will be determined to a large extent by Canada's traffic potential. When there is enough business for two lines to operate "at reasonable rates and with reasonable profit" the monopoly may be dispensed with, according to Canada's Prime Minister Louis St. Laurent.

Speaking at the annual meeting of the Air Industries and Transport Association in Ottawa, St. Laurent made reference to the situation which existed during the railroad-building era, when two or more lines would compete for traffic that would not have supported either one alone. Canada, he declared, intends to avoid any repetition of such a "wasteful misuse of resources and manpower."

Flight Refueling Move

Flight Refueling, Inc., of Danbury, Conn., will shortly build a new plant adjacent to Friendship Airport, Baltimore. The firm builds the probe-and-drogue refueling system. After the new facilities are completed the firm will give up its Connecticut site.

FTL-Slick Still Plan to Merge

The Flying Tiger Line and Slick Airways still intend to merge, according to a joint statement made by the two carriers. Passing of a target date of October 1 without a decision on the proposal by the CAB had produced rumors that one or both might withdraw.

A favorite report on the merger was made recently by CAB Examiner F. Merritt Ruhlen. Final CAB decision is possible within the next six weeks.

Business as Usual Forecast by ACTA

Withdrawal of the Independent Military Air Transport Association (IMATA) from joint operations with the Aircoach Transport Association (ACTA) in handling military charter business will not affect ACTA's work in that field, according to Hamlin B. Johnston, executive director of ACTA.

Johnston also took issue with an IMATA statement to the effect that the Joint Control Board, in which both groups participated, had not been satisfactory. ACTA has offices on approximately 56 military installations and services military charter movements with a field force of over 150 representatives.

Babb Merger Due

Merger of the Babb Co., Inc., which is wholly owned by Floyd B. Odlum's Atlas Corp., and the American Airmotive Corp. of Miami is due for early consummation. Surviving firm will be Babb. American Airmotive is currently engaged in modifying a C-46 firewall.

U. S. Airlines Has New President

U. S. Airlines, certificated cargo carrier, has a new president and is attempting to resume operations in the near future.

John H. Hutchinson has been named president and Bernard J. Chubet vice president-treasurer. Hutchinson has been with Northwest Airlines for many years and was serving at the company's Washington sales manager just prior to his resignation in 1951. He was later named chief of National Production Authority's aircraft division.

Chubet has been in the investment business in New York.

Service to Mexico Withdrawn by TCA

Proposed service by Trans-Canada Air Lines from Montreal to Mexico City via Tampa, Florida, has been withdrawn because of objections by the CAB and the U. S. State Department.

The Canadian carrier could fly directly from Canada to Mexico, or make operational stops in the U. S., according to officials, but could not make the new service an extension of its present Canada-U. S.-Caribbean route. The service was to have started around the end of October.

T-34 Under Test

First production model of Beechcraft's T-34A trainer, the Mentor, has arrived at Edwards Air Force Base for Phase Six operational suitability tests. The T-34 is all metal and has a tricycle landing gear, a top speed of 189 mph, a cruising speed of 173 mph at 60% power and a service ceiling of 20,000 feet.

Exchange of Malfunction Information Proposed

A system of exchanging information on malfunctions in corporate aircraft could be set up by the CAA if the business operators were interested, according to Administrator Fred B. Lee. Addressing the National Business Aircraft Association in St. Louis, Lee told the corporate flyers that real evidence of their interest in the project would be needed before the agency would burden either itself or them with any additional red tape.

Lee also suggested that businessmen avail themselves of facilities for checking radio, and navigational equipment and reviewing instrument flying ability.

At the meeting Cole Morrow was re-elected chairman of the board and Henry W. Boggess was elected to the newly created position of vice chairman.

Honor Trophy Winners

Three Harmon Trophy winners for 1953, Col. Bernt Balchen, Mme. Jacqueline Auriol, and Walter L. Massic, will be honored at a luncheon on November 10 in Washington, D. C. The gathering, held at the Hotel Statler, will be sponsored by the trustees of the Clifford B. Harman Trust.

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Fokker Flies His "Spider"— 1910

By himself, Anthony Fokker built and flew his first airplane, "The Spider", as a young man of 20. Shown here taking off at a good angle of climb for those days, this plane, with its one-man crew, had no ailerons or wing-warping devices, being inherently stable. In "The Spider" Fokker won several awards from European governments in flying competitions. Later, during World War I, he became one of the world's outstanding airplane builders—and then, at the end of the war, recognizing the enormous possibilities of aviation in this country, Anthony Fokker came to the United States where his ideas, knowledge and skill made valuable contributions to the advancement of American aviation.

Improved fuels and lubricants, developed by the petroleum industry, have made possible many of the dramatic advancements in aircraft performance during the past half century.

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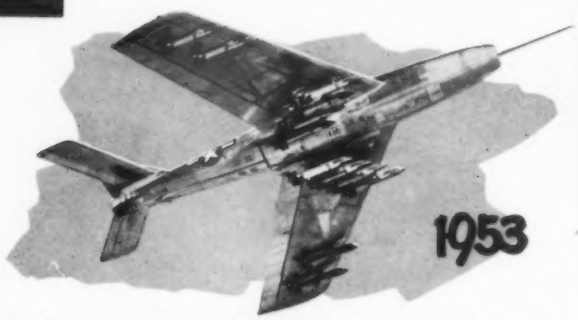

One-man crew, modern version—The U. S. Air Force's F-84F Thunderjet is today one of the largest aircraft handled by a one-man crew. As a fighter-plane, the 'F' is capable of extremely high speeds and long range operations—and can carry more armament than the record-breaking loads of its sister model, the F-84E.

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